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HITHERTO UNPUBLISHED PLATES
OF
TERTIARY MAMMALIA
AND
PERMIAN VERTEBRATA

Prepared under the Direction of
EDWARD DRINKER COPE
for the
U. S. Geological Survey of the Territories
with
Descriptions of Plates
by
WILLIAM DILLER MATTHEW

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PREFATORY NOTE.

The accompanying plates were prepared and printed by the United States Government for the Report on Tertiary Vertebrata by E. D. Cope, forming Volumes III and IV of the final report of the Geological and Geographical Survey of the Territories, F. V. Hayden in charge. The first part of this Report (Volume III), treating of the Eocene and a part of the Oligocene vertebrates was completed and published in 1885. The second part, treating of the remainder of the Oligocene and all the Miocene vertebrates, was never completed. A large number, but not all, of the plates for this part were prepared and printed, together with seven plates for a contemplated report on Permian Vertebrata.

The specimens illustrated are contained in the Cope Collection, purchased by the American Museum of Natural History. The ownership of certain parts of the collection having been satisfactorily adjusted it seemed proper that the plates should be distributed for the benefit of palæontologists, jointly by the United States Geological Survey and the American Museum of Natural History. The plate descriptions were prepared and the plates bound and distributed by the latter institution.

Illustrations of many of the specimens here figured, copied from these plates, have been published by Professor Cope, chiefly in the *American Naturalist* of 1880-1888. The nomenclature and identification of the material has been materially changed since 1880-1883 when the illustrations were made, and it has been thought advisable to give in the plate descriptions both Cope's identifications and the revision now current (1915). No text is known to have been prepared by the author, but the substance of his views and interpretations of the later Tertiary vertebrates of Western America may be found in his numerous publications dealing with fossil mammals, chiefly in the *American Naturalist*, and *Proceedings of the American Philosophical Society*, between 1880 and 1892, also in *Bulletins and Annual Reports of the U. S. Geol. Geog. Sur. Territories*, 1872-1882 and the *Texas Geological Survey Reports*, 1891-1893.

A number of plates illustrating the Brontotheriidae of the Oligocene of Colorado are included in the Monograph of that family by Henry Fairfield Osborn, and are omitted from the present series.

SCHEDULE OF PLATES.

Permian Vertebrata. Twelve plates; Nos. 1, 3, 7, 8, 10, 11, 12, 13, 16, 16a, 19, 22.

Oligocene Ungulata. Fifteen plates; Nos. 102, 104, 105, 108, 109, 109a, 110, 110a, 111, 112, 113, 113a, 115, 115a, 116.

Miocene Carnivora and Rodentia. Seven plates; Nos. 118, 118a, 118b, 119, 119a, 119b, 119c.

Miocene Proboscidea. Five plates; Nos. 120, 121, 122, 123, 124.

Miocene Rhinoceroses. Twenty plates; Nos. 125, 126, 127, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 144b.

Miocene Equidae. Seven plates; Nos. 145, 147, 148, 148a, 149, 150, 151.

Miocene Camelidae. Two plates; Nos. 153, 154.

PLATE I.

PERMIAN VERTEBRATA. MEGALICHTHYS

Nomenclature

Cope 1880-3	Revised 1915
Ectosteorhachis nitidus	Megalichthys (= Palaeobatrachus) nitidus

FIGS. 1-3. *Megalichthys nitidus* (Cope 1880). Type specimen, two-thirds natural size. Amer. Mus. No. 7239, Cope Coll. Wichita basin, Texas. Fig. 1, ventral view of head and fore part of trunk; fig. 2, 2a, 2b, dorsal, lateral and anterior views of head. (Fig. 4 is not identified).

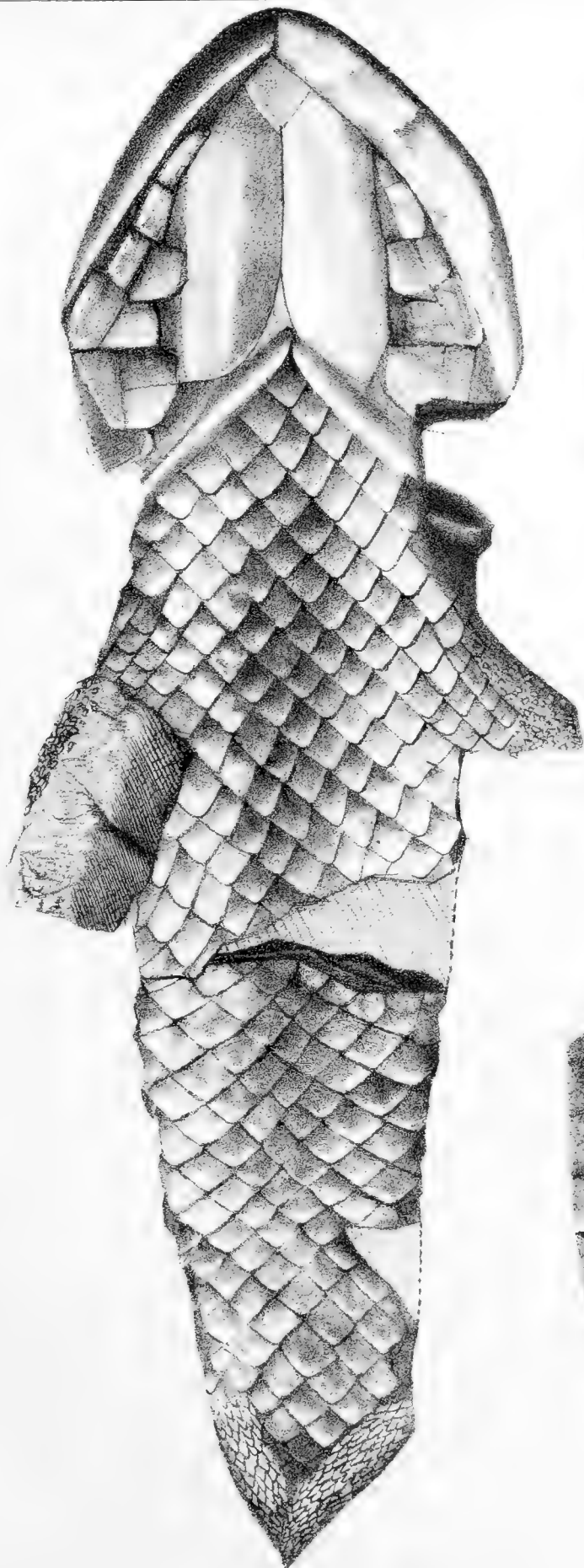


PLATE III.

PERMIAN VERTEBRATA

VERTEBRATE REMAINS FROM VERMILLION CO., ILLINOIS

Nomenclature

Cope, 1880-3	Revised, 1915
<i>Orthacanthus quadriseriatus</i>	<i>Pleuracanthus quadriseriatus</i>
<i>Diplodus compressus</i>	<i>Diacranodus texensis</i>
<i>Ctenodus pusillus</i>	<i>Gnathorhiza pusilla</i>
“ <i>gurleyanus</i>	<i>Sagenodus fossatus</i>
“ <i>fossatus</i>	“ <i>fossatus</i>
<i>Ceratodus paucicristatus</i>	“ <i>paucicristatus</i>
“ <i>vinslovii</i>	“ <i>vinslovii</i>
<i>Peplorhina arctata</i>	<i>Sphærolepis arctata</i>
<i>Janassa strigilina</i>	<i>Janassa strigilina</i>
“ <i>gurleiana</i>	“ <i>gurleiana</i>
<i>Archæobelus vellicatus</i>	<i>Archæobelus vellicatus</i>
<i>Cricotus heteroclitus</i>	<i>Cricotus heteroclitus</i>
<i>Lysorophus tricarinatus</i>	<i>Lysorophus tricarinatus</i>
<i>Diplocaulus salamandroides</i>	<i>Diplocaulus salamandroides</i>

FIGS. 1-50. Vertebrate remains from the Permian bone bed of Vermillion County Illinois. This fauna described by Professor Cope in 1877 was the first Permian fauna found in North America, and contains the genotypes of many of the genera later described from better material in Texas and New Mexico. The collection is the property of the Walker Museum of the University of Chicago, and has been redescribed by Dr. E. C. Case (1900) in the *Journal of Geology*, Vol. VIII, pp. 698-729, with five plates of figures. The revised nomenclature is auct. Case and Hussakof 1911.

FIGS. 1, 1a. *Pleuracanthus quadriseriatus* (Cope, 1877). Fragment of head spine, $\times 2$. Type specimen, No. 6502, Walker Mus. (Case, 1900, pl. i, fig. 3).

FIGS. 2-4. *Diacranodus texensis* (Cope, 1890). Teeth, No. 6504, Walker Mus., referred by Cope to *Diplodus* (*Didymodus*) *compressus* Newberry. (Case, 1900, pl. i, fig. 5; I am unable to state the enlargement, as Dr. Case does not give it in his figure, nor have measurements been published).

FIG. 5. *Sphærolepis arctata* (Cope, 1877). Dentigerous plate, $\times \frac{3}{2}$. Type specimen No. 6511, Walker Museum. (Hussakof, 1911, pl. xxxi, fig. 2).

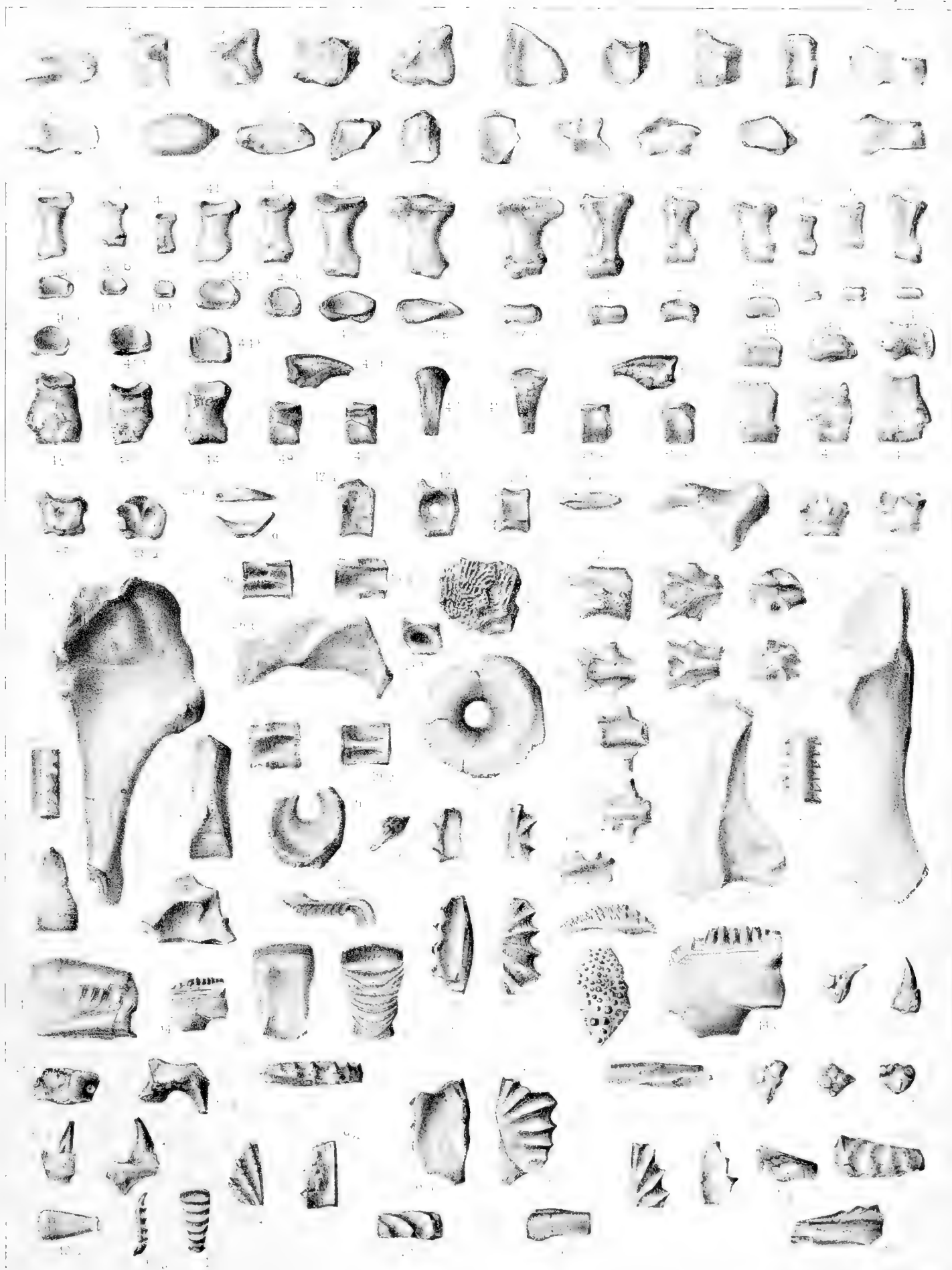
FIG. 6, 6a, 6b, 6c. *Gnathorhiza pusilla* (Cope, 1877). Right palatal plate, $\times \frac{3}{2}$, type specimen, No. 6508, Walker Mus. (Case, 1900, pl. i, fig. 9; Hussakof, 1911, pl. xxvii, fig. 10).

FIG. 7, 7a, 7b. *Sagenodus fossatus* (Cope, 1877). Upper dental plate, natural size, No. 6509, Walker Mus., type of *Ctenodus gurleyanus* Cope, 1877. (Case, 1900, pl. i, fig. 8; Hussakof, 1911, pl. xxvi, fig. 9).

FIG. 8, 8a, 8b, 8c. *Sagenodus fossatus* (Cope, 1877). Imperfect left mandibular plate, immature, about $\frac{8}{9}$ natural size. Type specimen, No. 6506, Walker Museum. (Case, 1900, pl. i, fig. 10; Hussakof, 1911, pl. xxvi, fig. 8).

FIG. 9, 9a, 9b, 9c. *Sagenodus paucicristatus* Cope, 1877. Imperfect dental plate, natural size, Type specimen, No. 6505 Walker Mus. (Case, 1900, pl. i, fig. 11; Hussakof, 1911, pl. xxvii, fig. 4).

- FIG. 10, 10a, 10b, 10c. *Sagenodus vinslovi* (Cope, 1875). Incomplete left palatal plate, natural size, Type specimen, No. 6507 Walker Mus. (Case, 1900, pl. i, fig. 6; Hussakof, 1911, pl. xxvii, fig. 7).
- FIG. 11, 11a, 11b. *Janassa strigilina* Cope, 1881. Tooth probably of median series, twice natural size. Type specimen, No. 6500 Walker Mus. (Case, 1900, pl. 1, fig. 1; Hussakof, 1911, pl. xxvi, fig. 1).
- FIG. 12, 12a, 12b. *Janassa gurleiana* Cope, 1878. Small tooth, lacking the root, twice natural size. Type specimen, No. 6501, Walker Mus. (Case, 1900, pl. i, fig. 2; Hussakof, 1911, pl. xxvi, fig. 2).
- FIG. 13, 13a, 13b, 13c. *Archaeobelus villicatus* Cope, 1877. Jaw fragment with tooth, about natural size. Type specimen, No. 6524, Walker Mus.
- FIG. 14, 14a. Undetermined jaw fragment, "Species two" of Cope, 1877, auct. Case (agrees better with "species one" of Cope's description), natural size and enlarged to $\frac{2}{1}$. No. 6567, Walker Mus. (Case, 1900, pl. v, fig. 12). FIG. 14b, tooth, undet.
- FIG. 15, 16. *Cricotus heteroclitus* Cope, 1875. Two intercentra, ? types of *C. discophorus* Cope, 1877, natural size, Walker Mus., ? No. 6518. (Case, 1900, pl. i, figs. 13-14).
- FIG. 17, 17a, 17b. *Cricotus gibsoni* Cope, 1877. Supposed caudal vertebra, natural size. Type specimen, No. 6521, Walker Mus. Case, 1900, pl. i, fig. 15.
- FIG. 18. ? *Diplocaulus*, fragment of sculptured plate.
- FIGS. 19-20. *Lysorophus tricarinatus* Cope, 1877. Two vertebral centra, twice natural size. Typical specimens. No. 6526-8, Walker Mus. (Case, 1900, pl. ii, fig. 12).
- FIGS. 21-23. *Diplocaulus salamandroides* Cope, 1877. Vertebrae, about $\frac{2}{3}$ natural size. Typical specimens, Nos. 6513-6, Walker Mus. (Case, 1900, pl. v, fig. 17).
- FIG. 24. Unidentified jaw fragment "Species one" of Cope, 1877, auct. Case (agrees better with "species two" of Cope's description). No. 6567, Walker Mus. (Case, 1900, pl. v, fig. 12). Probably enlarged, but as Cope gives no measurements and Case does specify the enlargement on his figure I can not determine how much.
- FIG. 25. Unidentified.
- FIG. 26, 26a, 26b. *Clepsydropus ? pedunculatus* Cope, 1877. Humerus, lacking distal end. Half natural size. No. 6542, Walker Mus. (Case, 1900, pl. iii, fig. 5; reference auct. Case).
- FIG. 27. Unidentified.
- FIG. 28. Unidentified vertebra.
- FIG. 29. " intercentrum.
- FIGS. 30-35. Pelycosaurian carpal and tarsal bones, unidentified, probably *Clepsydropus*. No. 6559, Walker Mus. (Case, 1900, pl. v, figs. 18-21.) Enlargement not determined.
- FIGS. 37-47. *Clepsydropus* metapodials and phalanges. Enlargement not determined. Nos. 6563-5, Walker Mus. (Case 1900, pl. v, figs. 3-10).
- FIGS. 48-49. ? Podial bones of Pelycosaurians.
- FIG. 50. Coprolite. No. 6574, Walker Mus.



1-4 SELACHID 5-10 DIPNOI 11-12 LANIASSA 13 ARCHAEON
 19-20 LYSOROPHUS 21-23 DIPLOCAULUS 24-48 ...

PLATE VII.

PERMIAN VERTEBRATES. TRIMERORHACHIS

FIG. 1, 1a. *Trimerorhachis insignis* Cope, 1878. Skull, superior and inferior views, natural size. Metatype, Amer. Mus. No. 4557, Cope Coll., Permian, Wichita basin, Texas.

FIGS. 2, 2a, 3. ?*Trimerorhachis*, not identified.

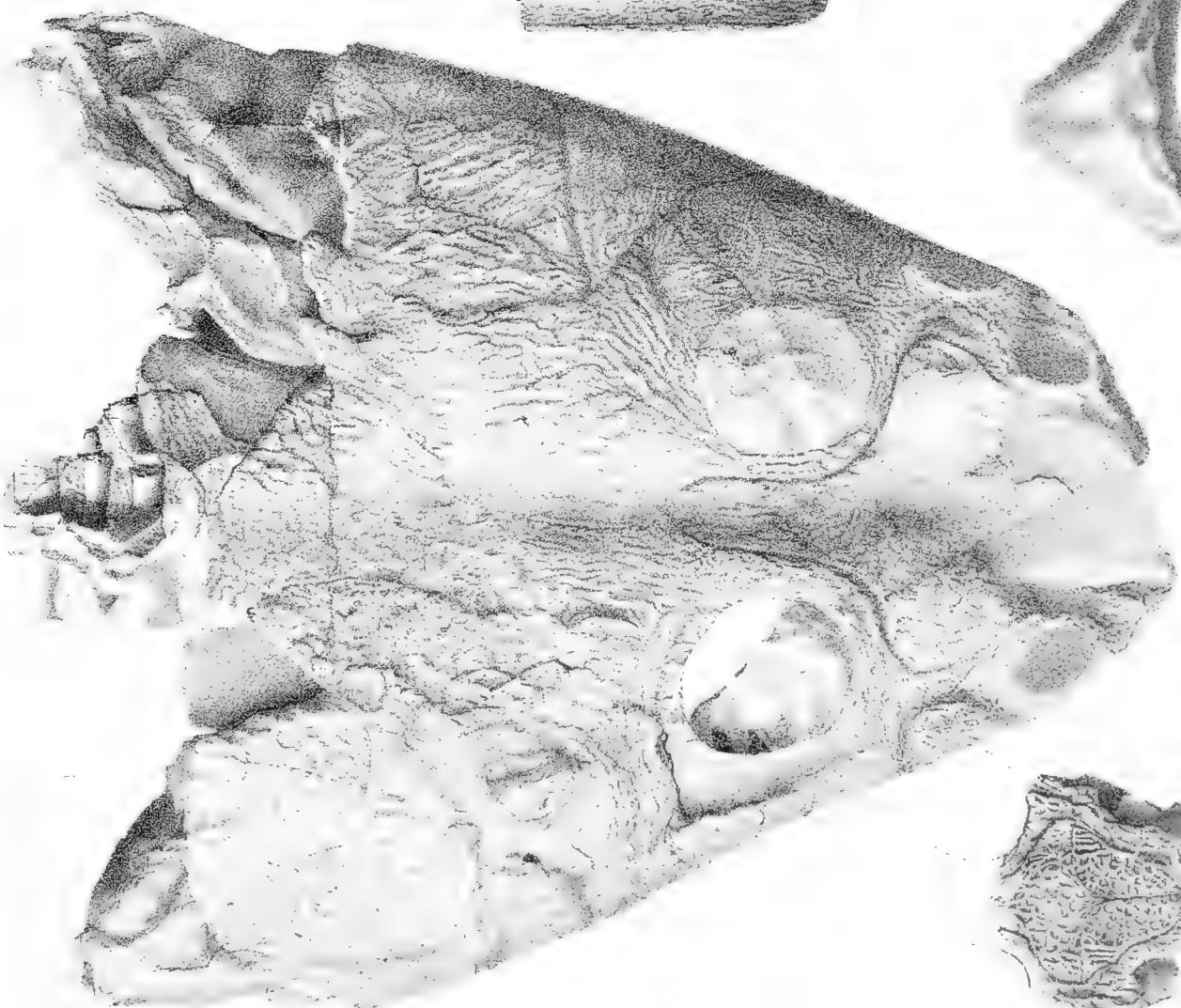
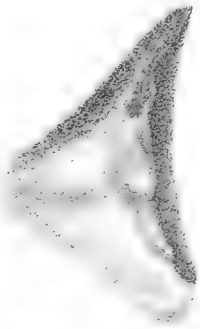
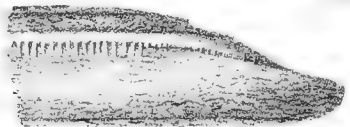
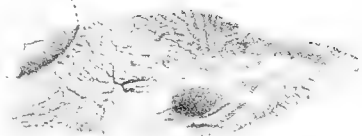


PLATE VIII.

PERMIAN VERTEBRATA. TRIMERORHACHIS

FIGS. 1-11. *Trimerorhachis insignis* Cope, 1878. Occiput, jaws, vertebræ and limb bones, natural size. Type specimen, Amer. Mus., No. 4565, Cope Coll. Lower Permian, Wichita Basin, Texas.

PLATE X.

PERMIAN VERTEBRATA. ERYOPS

Eryops megacephalus Cope, 1878. Complete skull, superior view, four-sevenths natural size.
Type specimen, Amer. Mus. No. 4189, Cope Coll. Lower Permian, Wichita basin, Texas.

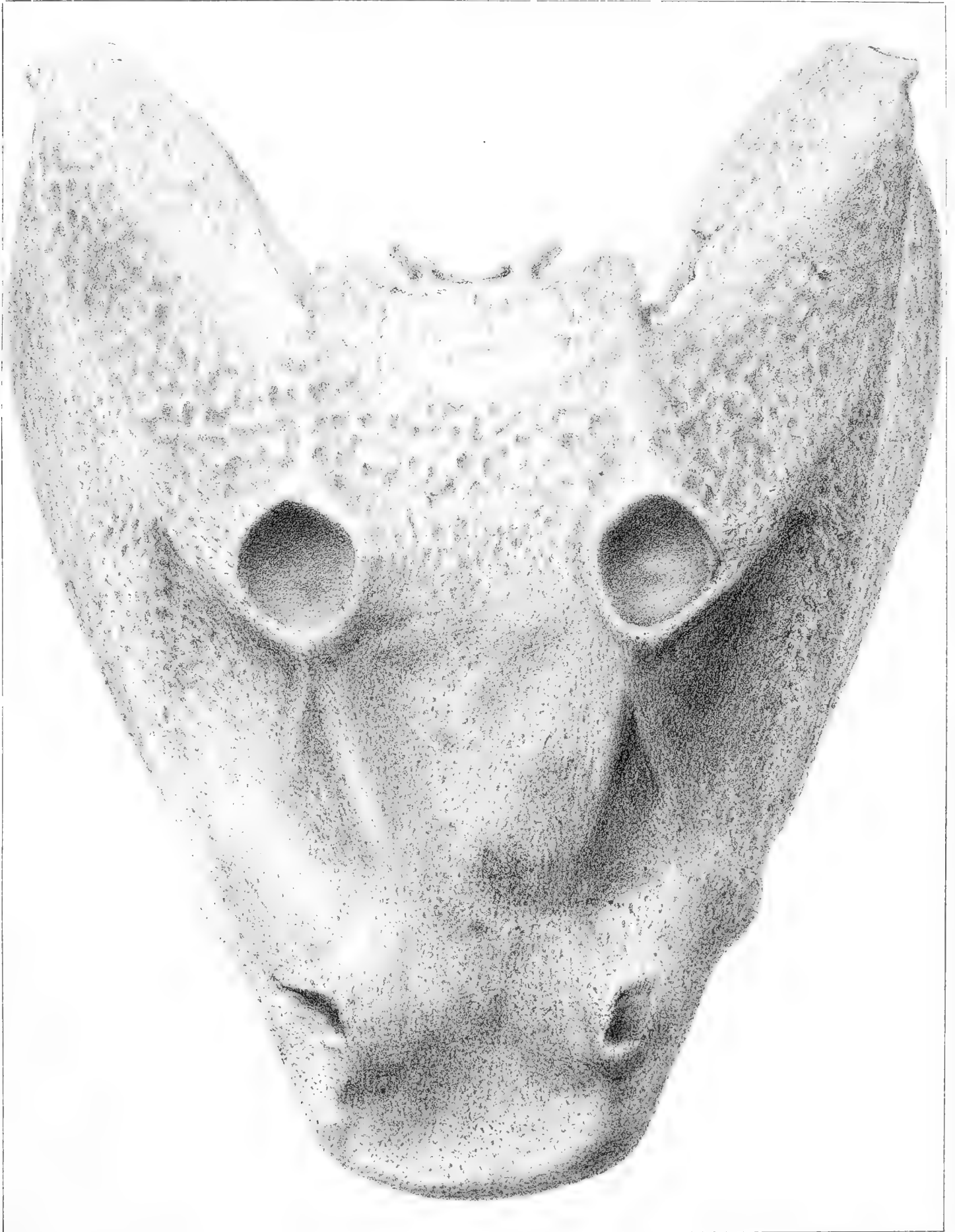


FIGURE 1. Fossilized skull of a primate or early hominid.

PLATE XI.

PERMIAN VERTEBRATA. SKULL OF ERYOPS

FIGS. 1-2. *Eryops megacephalus* Cope, 1878, side view of skull and lower jaw and under view of lower jaw, four sevenths natural size. Type specimen, Amer. Mus., No. 4189, Cope Coll. Lower Permian, Wichita basin, Texas.



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PLATE XII.

PERMIAN VERTEBRATA. JAWS AND VERTEBRÆ OF ERYOPS

FIGS. 1-9. *Eryops megacephalus* Cope, 1878. Lower jaw and vertebræ, Amer. Mus. No. 4183, Cope Coll., from Lower Permian, Wichita Co., Texas. Specimens figured on Pl. xiii.

Fig. 1, 1a, lower jaw, $\frac{2}{5}$ natural size; fig. 2, 2a, cervical 3, 3a, dorsal, 4, 4a, sacral, and 5, 5a, caudal vertebræ all $\frac{2}{5}$ natural size; fig. 6, anterior vertebra, natural size; fig. 7 posterior dorsal vertebra, natural size; figs. 8-10 not identified.

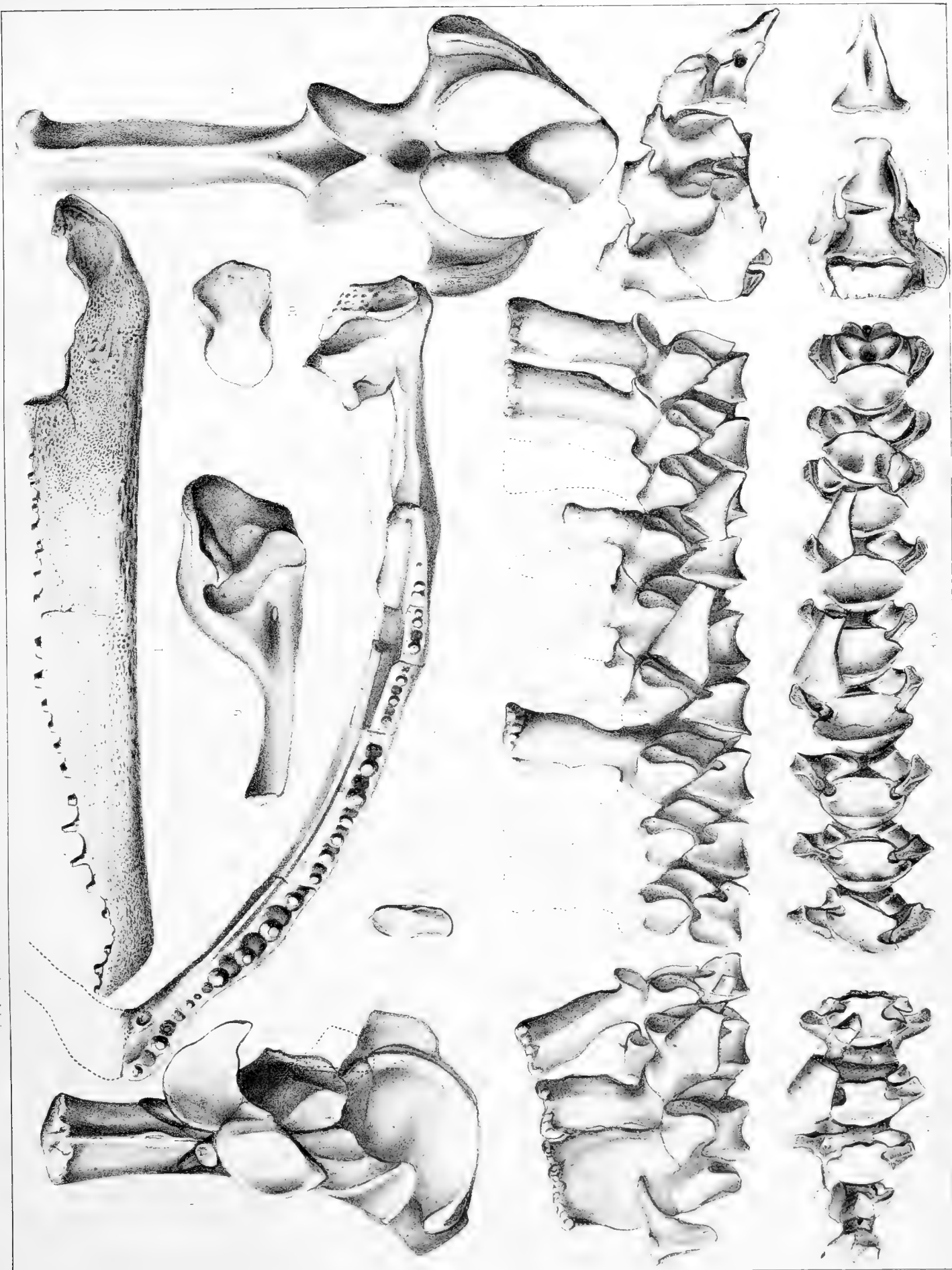


PLATE XIII.

PERMIAN VERTEBRATA. LIMB BONES OF ERYOPS

FIGS. 1-6. *Eryops megacephalus* Cope, 1878. Scapula pelvis and femur, all two fifths natural size. Amer. Mus. No. 4183, Cope Coll., figured on pl. xii.

Fig. 1, 1a. Scapula-coracoid, inner and outer views of lower portion; fig. 2-5, pelvis, outer, anterior, posterior and inferior views; fig. 6, 6a, 6b, 6c, 6d, femur, external anterior, posterior, proximal and distal views.

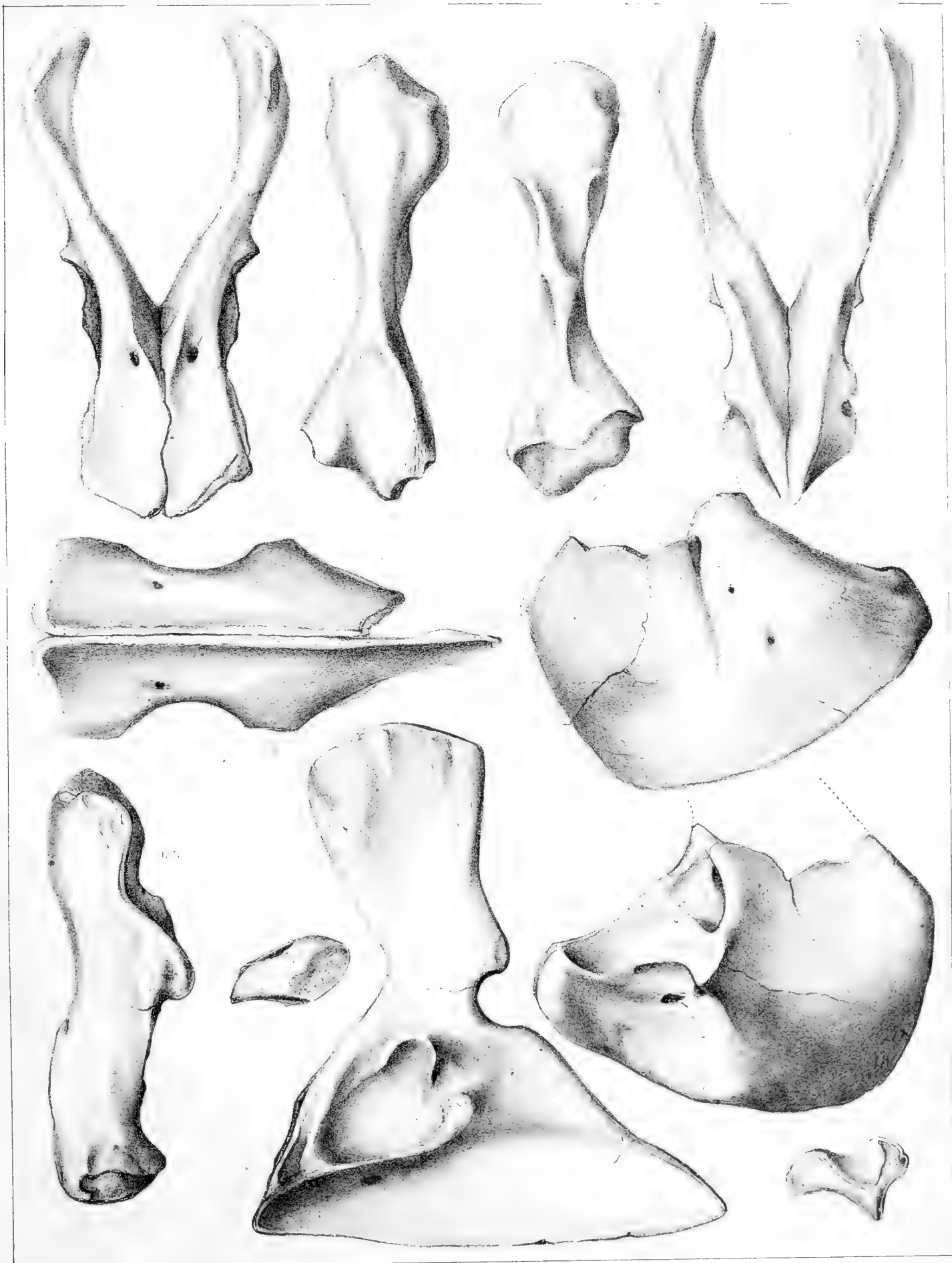


PLATE XVI.

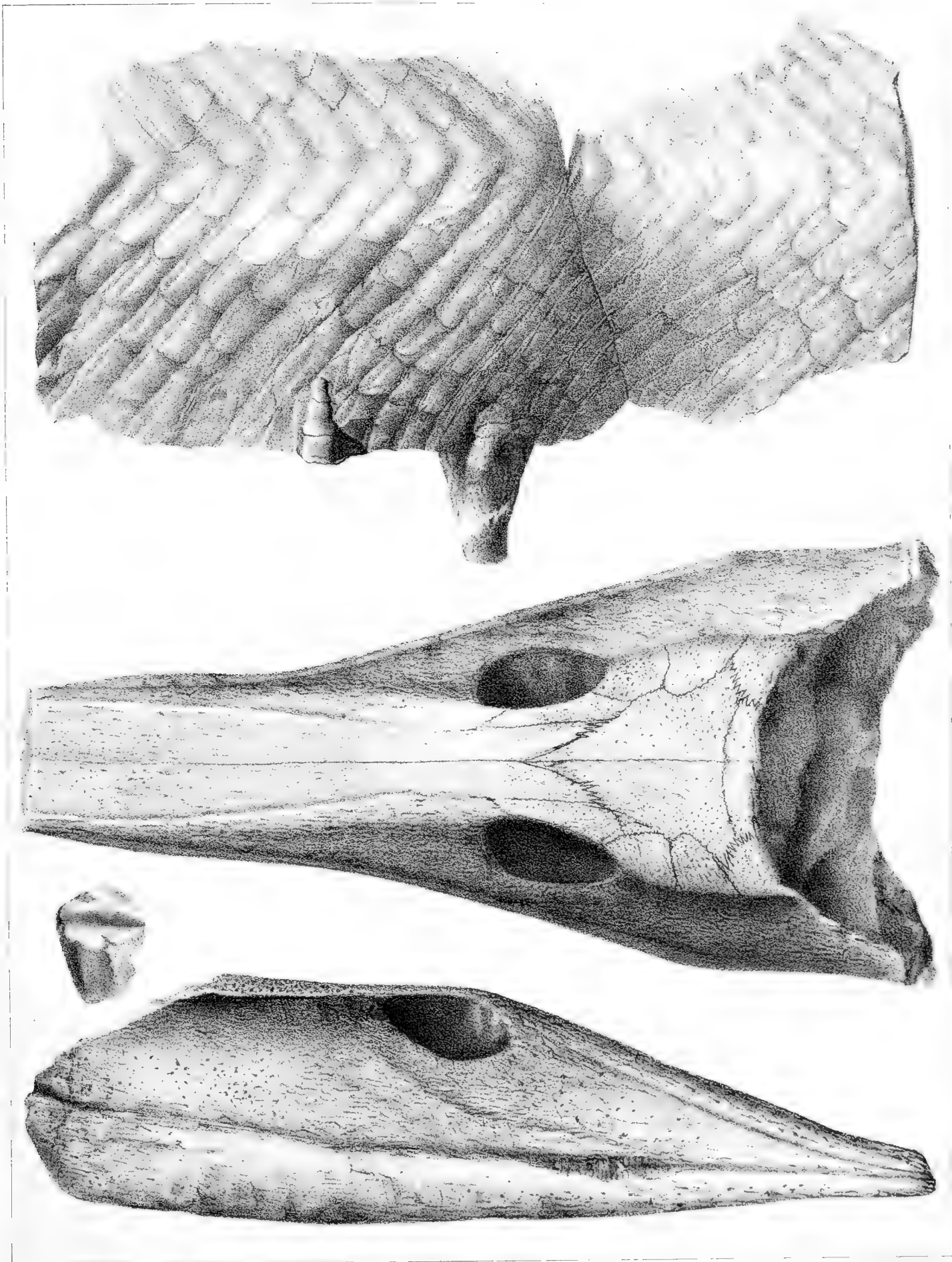
PERMIAN VERTEBRATES. SKELETON OF CRICOTUS

Figs. 1, 2 & 8, and probably 3-7 and 9. *Cricotus crassidiscus*, portions of skeleton, natural size. Am. Mus. No. 4550a, Cope Coll., Lower Permian, North Fork of Little Wichita River, Texas. Fig. 1, neck and anterior part of trunk; fig. 2, posterior part of trunk to anterior part of tail; fig. 3, middle portion of tail. The remaining figures are probably of this individual, but I am unable positively to identify them. The specimen has been much more thoroughly pieced together since it was acquired by the American Museum, being in fact a nearly complete articulated skeleton, lacking only the distal parts of limbs and feet. With it was associated a second skeleton, lacking the skull and jaws, but otherwise almost as complete as the other. Professor Cope appears to have considered both as portions of a single skeleton.

PLATE XVIa.

PERMIAN VERTEBRATES. SKULL AND VENTRAL ARMOR OF CRICOTUS

- FIG. 1. *Cricotus crassidiscus*. Cope, 1884. Portion of ventral armor, pelvic region, natural size. Co-type. Am. Mus. No. 4550, Cope Coll.
- FIG. 2. *Cricotus crassidiscus* Cope, 1884. Skull and lower jaws, top and side views, natural size. Co-type (lectotype) No. 4550a, figured on pl. xvi.



CRIOCTU.

PLATE XIX.

PERMIAN VERTEBRATES. SKULL OF DIADECTES

Nomenclature

Cope 1880-3
Empedocles molaris

Revised 1915
Diadectes molaris

- FIGS. 1-4. *Diadectes molaris* Cope, 1878. Skull, natural size, Amer. Mus. No. 4350, Cope Coll. Lower Permian, Little Wichita R., Texas. Fig. 1, palatal view restored; fig. 2, side view, missing parts in outline; fig. 3, occipital view, missing parts in outline; fig. 4, premaxilla, anterior view; fig. 5, crown view of upper teeth.
- FIGS. 5-6. *Diadectes ? fissus* (Cope, 1883). Upper and part of lower jaw, natural size, ? No. 4348, Cope Coll., Lower Permian, Wichita Basin, Texas.

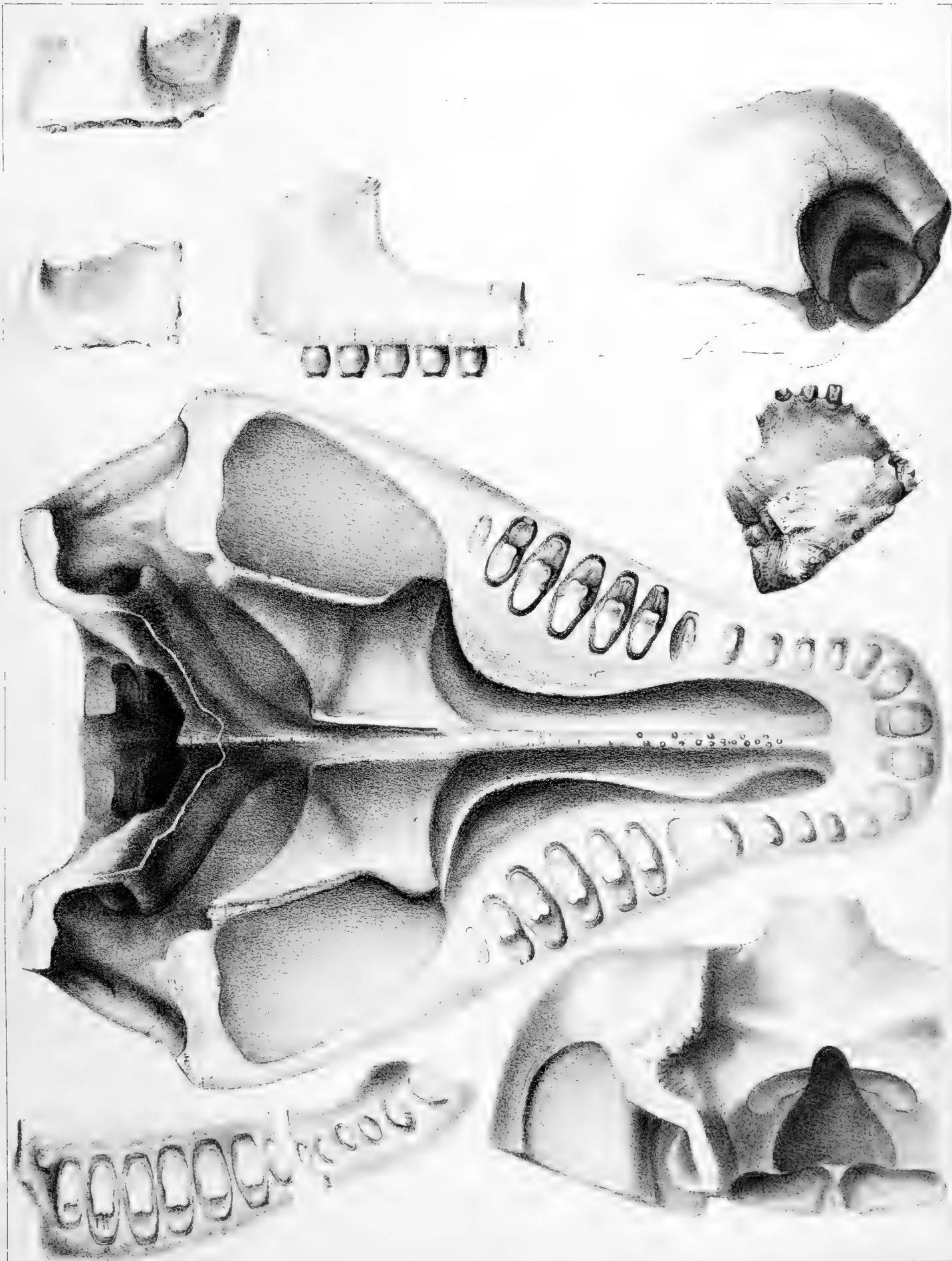
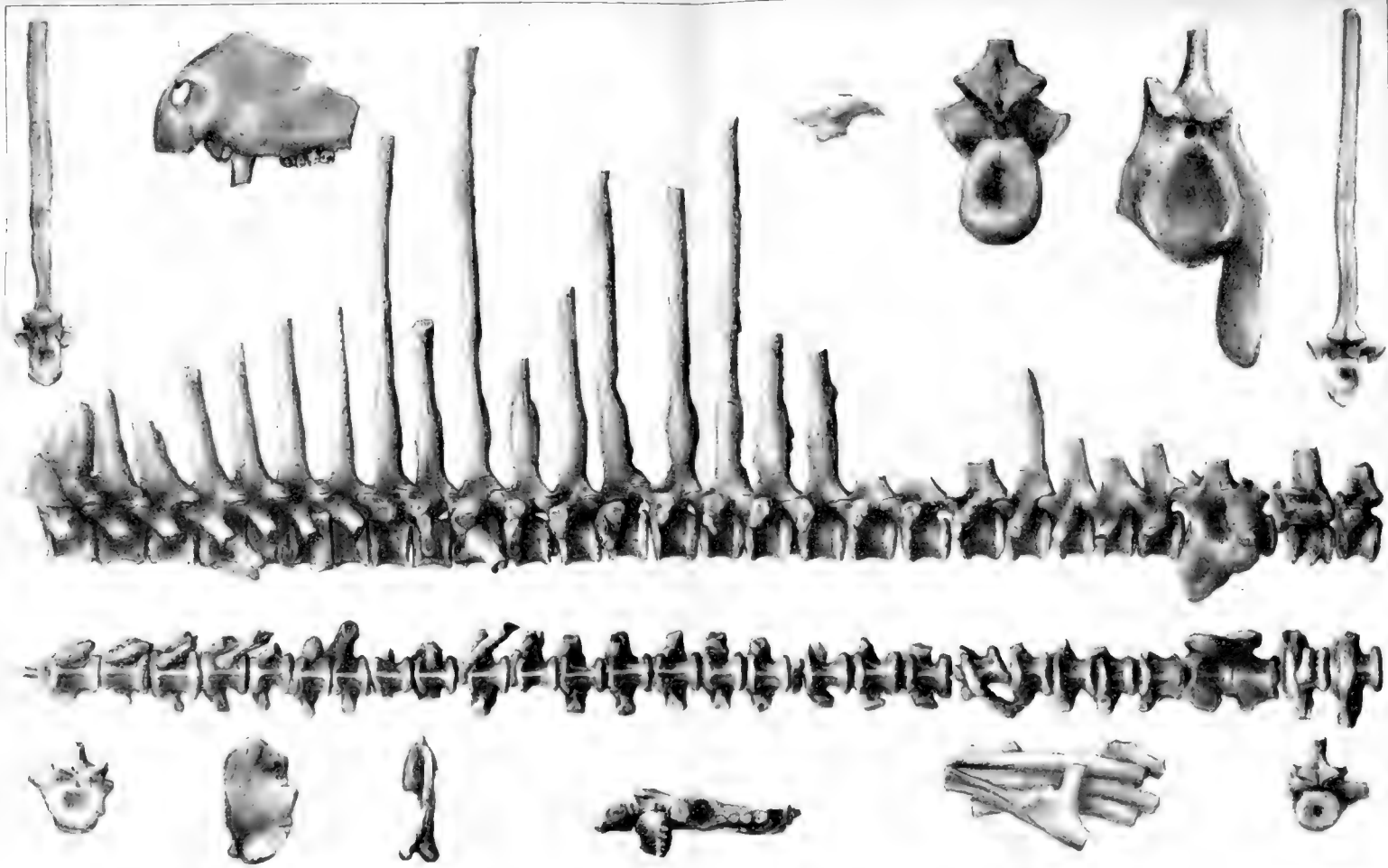


PLATE XXII.

PERMIAN VERTEBRATES. SKELETON OF DIMETRODON

FIGS. 1-11. *Dimetrodon incisivus* Cope. Parts of skull and vertebræ, two-fifths natural size (except figs. 8-9). Amer. Mus. No. 4008, Cope Coll. Lower Permian, North Fork of Little Wichita River, Texas.

Fig. 1, 1a. Front of skull, with fragment of lower jaw attached, fig. 2, 2a, 2b, quadrate; figs. 3-5, vertebral column, axis to second caudal complete, spines mostly broken off; figs. 6, 7, anterior and posterior views of anterior dorsal vertebra (14th of this series); figs. 8, 9, posterior view of posterior dorsal and anterior view of sacral vertebra, both natural size; figs. 10, 10a, caudal vertebræ; fig. 11, mass of vertebral spines with head of rib attached.



CIMACODON INCISIVA

PLATE CII.

OLIGOCENE RHINOCEROSSES. HYRACODON

FIGS. 1-11. *Hyracodon arcilens* Cope, 1873. Type specimen. Amer. Mus. No. 6309, Cope Coll., Cedar Creek beds (Oreodon zone) of Logan Co., Colorado. All figures two fifths nature. Fig. 1, palate and lower jaws, left side; fig. 2, palatal view of palate; fig. 3, occiput, posterior and right side views; fig. 4, superior view of lower jaws; fig. 5, fragment unidentified; fig. 6, atlas, inferior view; fig. 7, 7a, 7b, axis, lateral superior and inferior views; 8, 8a, 8b, 8c, 8d, middle cervical vertebra, lateral, superior, inferior, anterior and posterior views; 9, 9b, 9c, 9d, corresponding views of first dorsal; 10, 11, anterior dorsals.

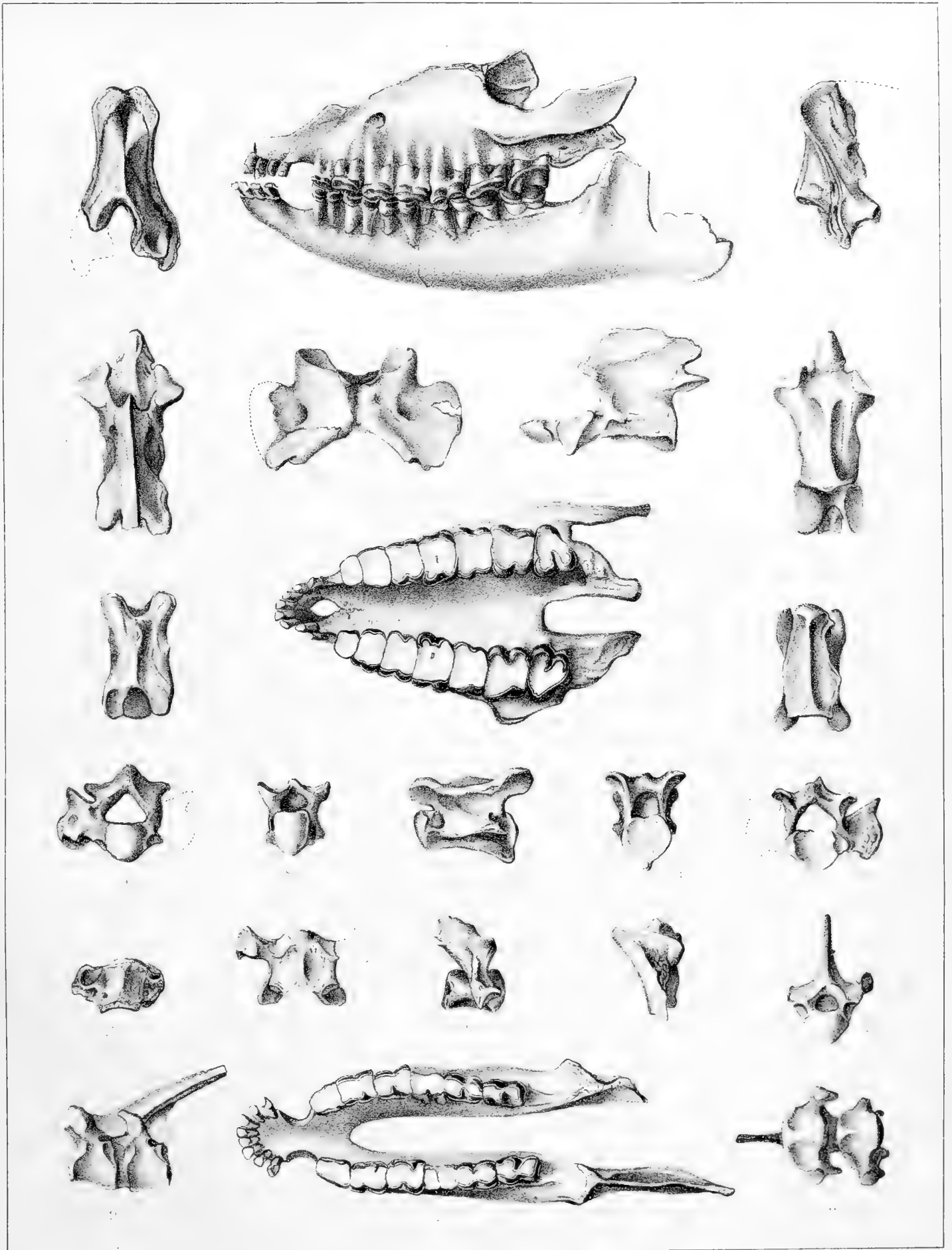


PLATE CIV.

LIMB BONES OF OLIGOCENE RHINOCEROSSES

Nomenclature

Cope 1880-3	Revised 1915
<i>Aceratherium occidentale</i>	<i>Cænopus</i> (= <i>Subhyracodon</i>) <i>mitis</i>
<i>Aceratherium pacificum</i>	<i>Diceratherium pacificum</i>

FIGS. 1-2. *Cænopus mitis* (Cope, 1874). Femur tibia and fibula, part of type specimen figured on pl. cv. Amer. Mus. No. 6325, Cope Coll., Horsetail Creek beds (*Titanotherium* zone), Logan Co., Colorado.

FIGS. 3-4. *Diceratherium pacificum* (Leidy, 1871). Femur and tibia with foot bones figured on pl. cv. Amer. Mus. No. 7340, Cope Coll., John Day formation of Oregon.

All figures are two-fifths natural size.

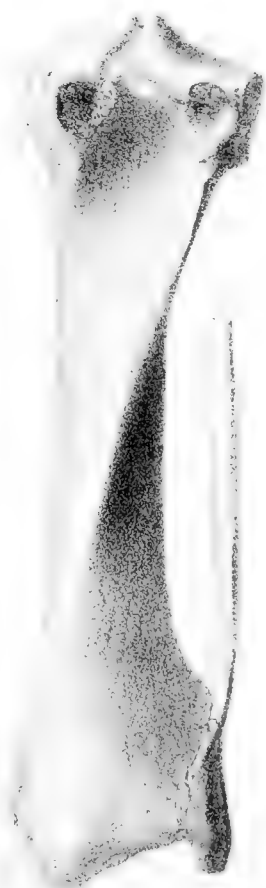


PLATE CV.

FOOT BONES OF OLIGOCENE RHINOCEROSES

Nomenclature

Cope 1880-3	Revised 1915
Aceratherium mite	Cænopus (= Subhyracodon) mitis
Diceratherium pacificum	Diceratherium pacificum

FIGS. 1-5. *Cænopus mitis* (Cope, 1874). Limb and foot bones of type specimen, Am. Mus. No. 6325, Cope Coll., Lower Oligocene, Horsetail Creek beds, Logan Co., Colorado. See pl. civ.

FIGS. 6-18. *Diceratherium pacificum*. Hind limb and foot bones. Am. Mus. No. 7340, Cope Coll., Upper Oligocene, John Day formation of Oregon.

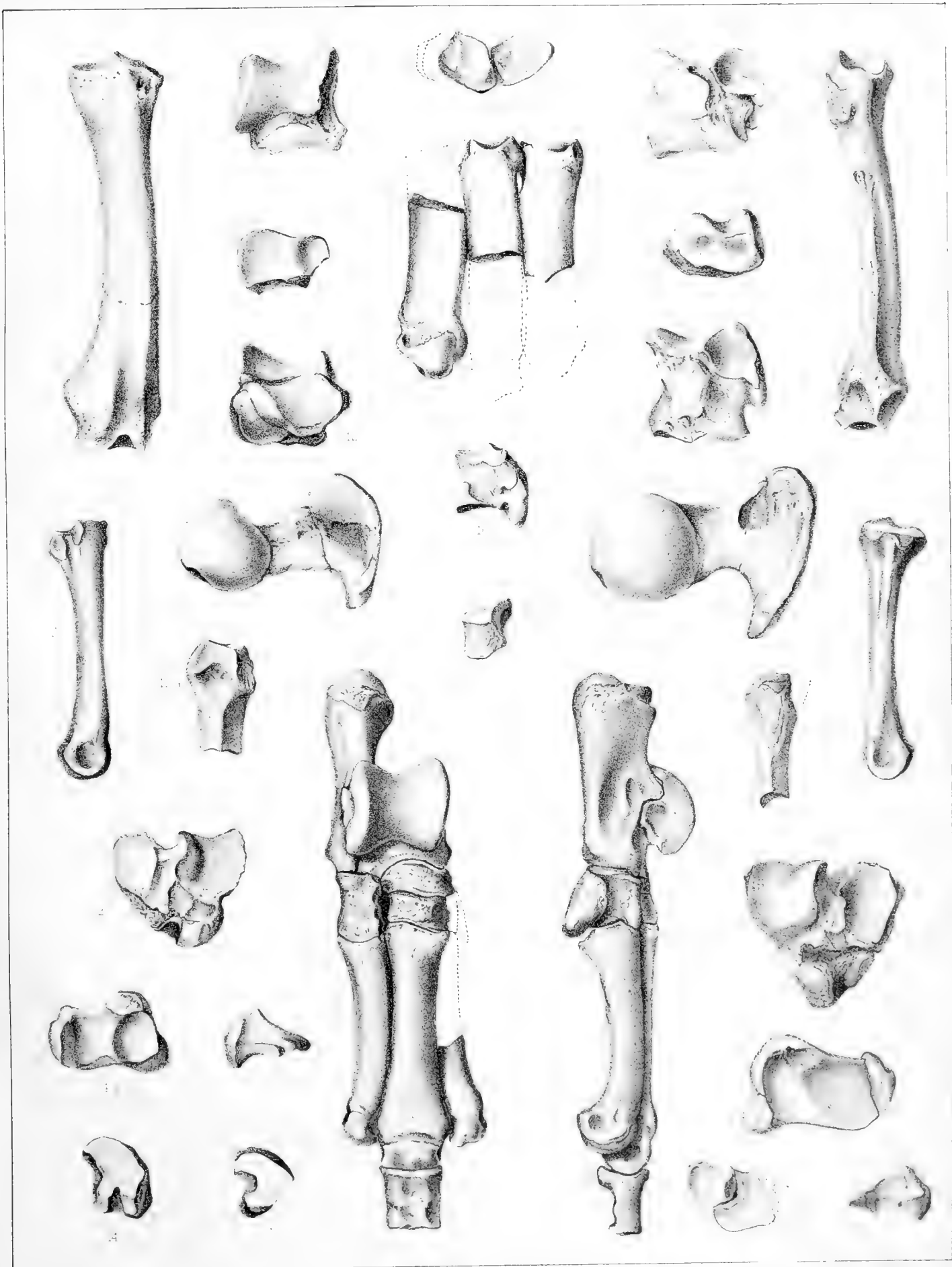


PLATE CVIII.

OLIGOCENE EQUIDÆ. "ANCHITHERIUM"

Nomenclature

Cope 1880-3	Revised 1915
<i>Anchitherium præstans</i>	<i>Kalobatippus præstans</i>

FIGS. 1-8. *Kalobatippus præstans* (Cope, 1879). Skull, jaws, hind foot and part of hind leg, one-half natural size, except fig. 8. Type specimen, Amer. Mus. No. 7269, Cope Coll., Upper Bed of John Day formation, Oregon. Fig. 1, side view of skull and jaws, 1a, palatal view of skull; fig. 2, superior view of lower jaw; fig. 3, 3a, distal end of femur, distal and external views; fig. 4, 4a, 4b, 4c, tibia, anterior, external, proximal and distal views; fig. 5a, proximal view of cuneiforms; fig. 6, 6a, 6b, 6c, metatarsus, internal, anterior, proximal and distal views; fig. 7, 7a, second phalanx of median digit, anterior and internal views; fig. 8, lateral ungual phalanx, natural size, all the preceding figures being one-half nature.

Kalobatippus gen. nov. Osborn. Upper molars with metaloph united to ectoloph as in *Anchitherium*, but m^3 and heel of m_3 unreduced and like *Miohippus* in pattern. Limb bones and metapodials much elongated, lateral digits unreduced from *Miohippus* stage; phalanges short; inner cuneiform of pes abutting upon cannon-bone.

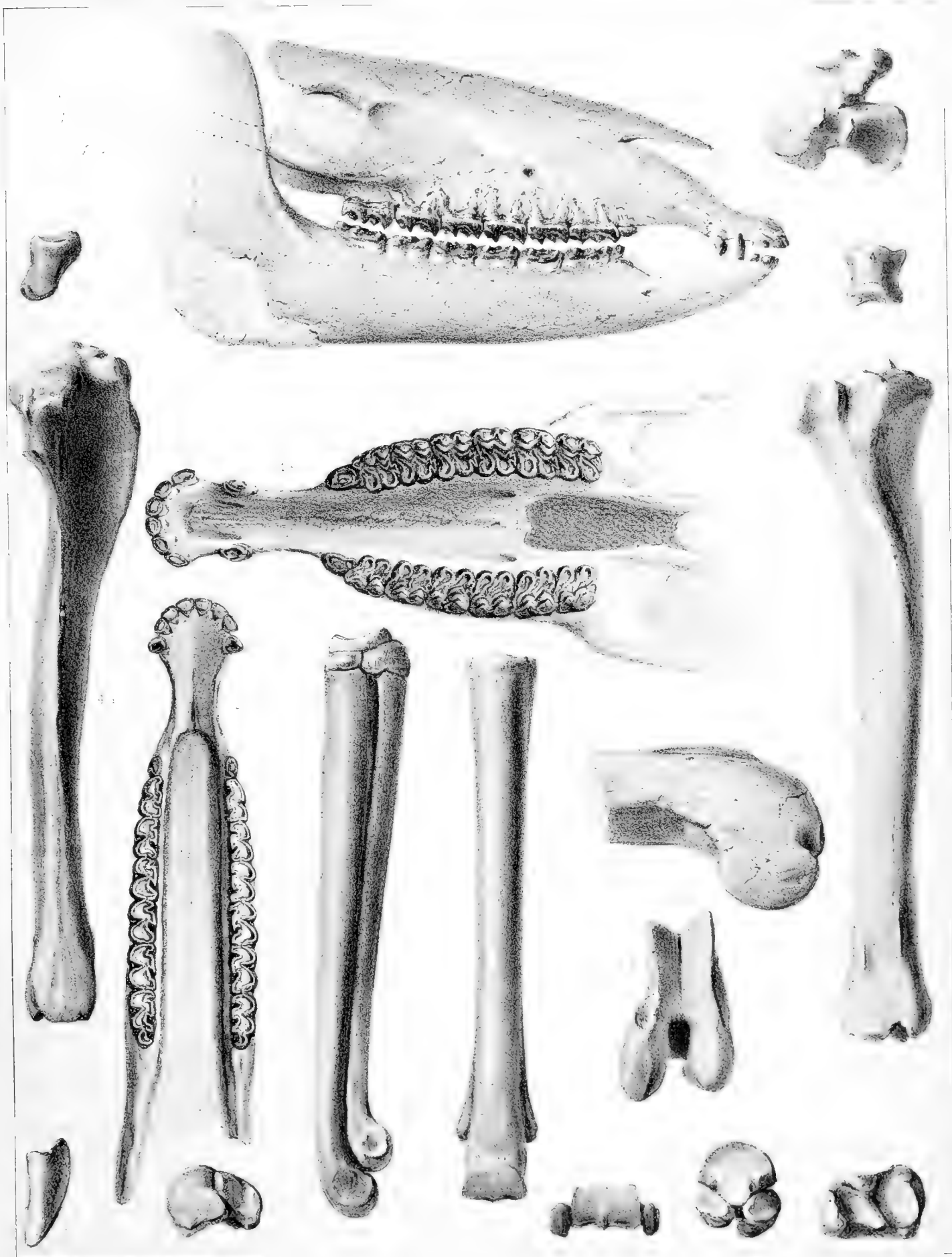


PLATE CIX.

OLIGOCENE ENTELODONTES. JAW OF PELONAX

Nomenclature

Cope 1880-3	Revised 1915
Elotherium ramosum	Pelonax ramosus

FIGS. 1-2. *Pelonax ramosus* (Cope, 1874). Lower jaw, side and top views, one-third natural size. Type specimen, Amer. Mus. No. 6393, Cope Coll. Upper Oreodon or Leptauchenia zone, Cedar Creek beds, N.-E. Colorado.

FIG. 3, unidentified.

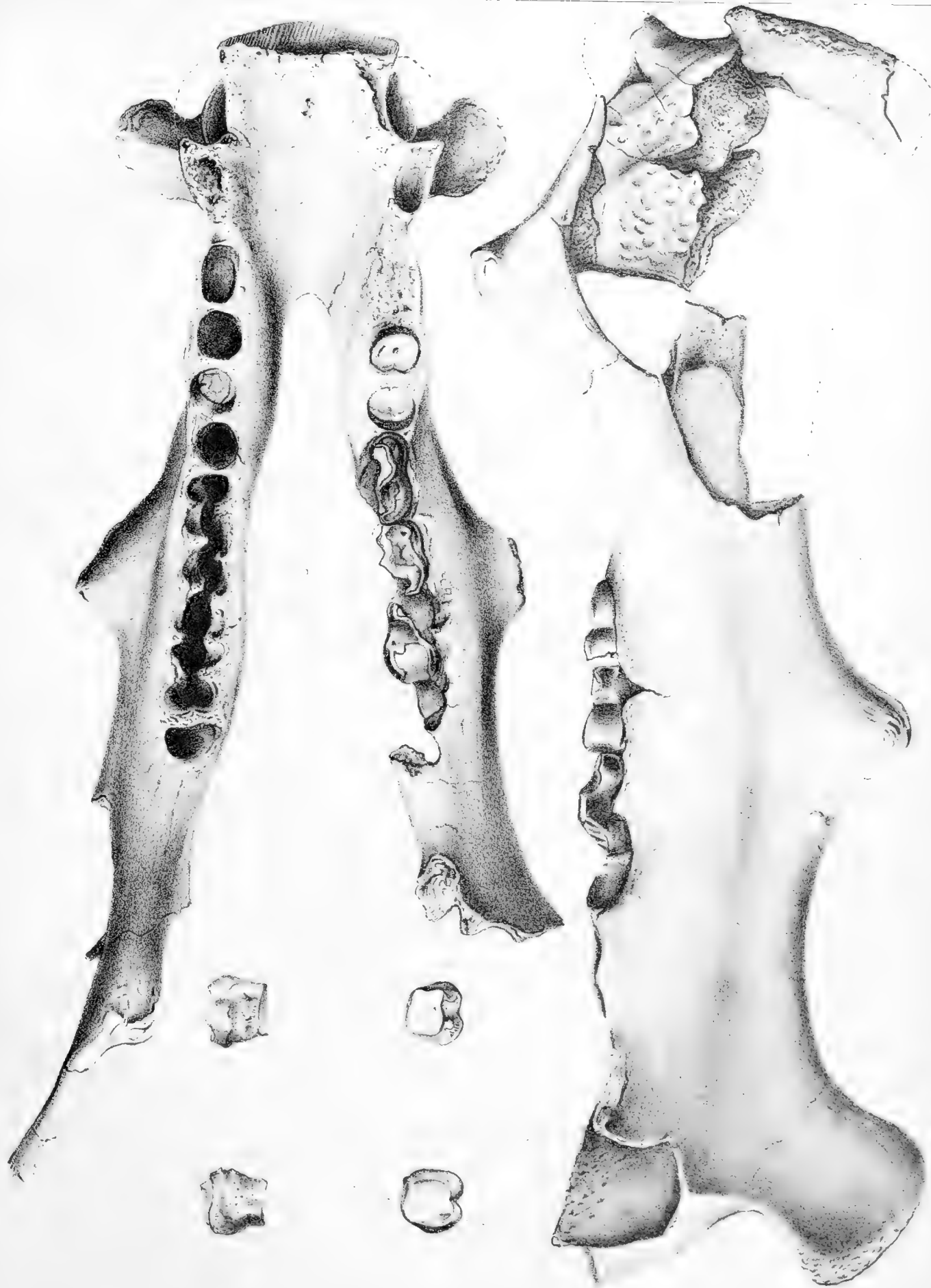


PLATE CIXa.

OLIGOCENE PECCARIES AND ENTELODONTES

Nomenclature

Cope 1880-3	Revised 1915
<i>Elotherium ramosum</i>	<i>Pelonax ramosus</i>
<i>Elotherium imperator</i>	<i>Entelodon imperator</i>
<i>Thinohyus pristinus</i>	<i>Perchærus pristinus</i>

- FIG. 1. *Pelonax ramosus* (Cope, 1874). Lower jaw, anterior view, one third natural size. Type specimen figured on Pl. cix.
- FIG. 2, 2a, 2b. *Entelodon imperator* (Leidy, 1873). Anterior end of lower jaw, superior, inferior and anterior views, one-third natural size. Amer. Mus. No. 7381, Cope Coll. John Day formation; Camp Creek, John Day Valley, Oregon.
- FIGS. 3-8. *Boöcharus humerosus* Cope, 1879. Parts of type skeleton, figured on pl. cx. Fig. 3, fore foot, external; fig. 4, proximal view of metacarpus; fig. 6, 6a, proximal phalanx, proximal and distal views; fig. 7, 7a, second phalanx, same views; fig. 8, proximal view of tibia. All one-third natural size.
- FIG. 9, 9a. *Perchærus pristinus* Leidy, 1873. Skull, lateral and palatal views, three-fifths natural size. Amer. Mus. No. 7391, Cope Coll., from the John Day formation of Oregon.

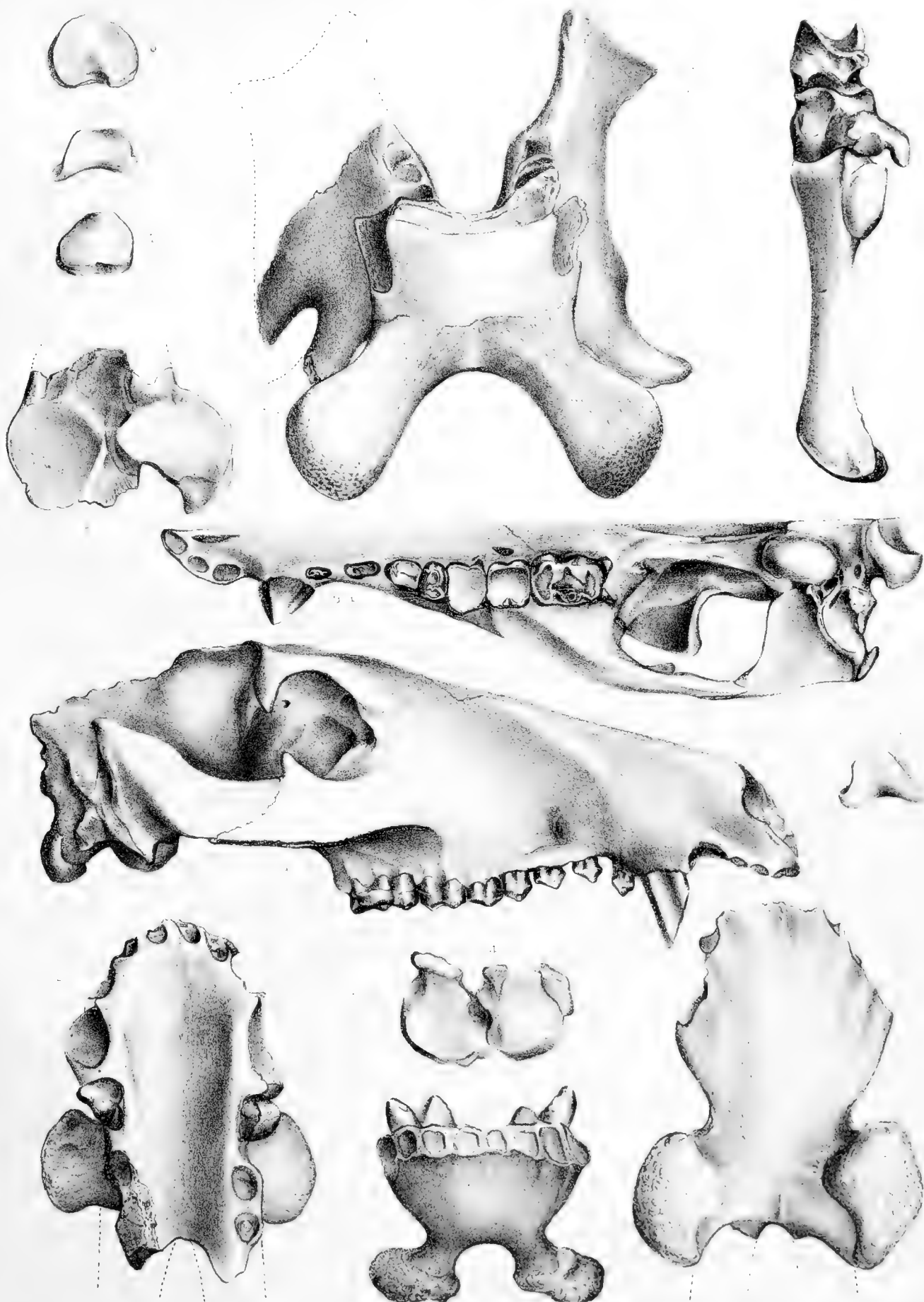


PLATE CX.

LIMB BONES OF BOÖCHÆRUS

Nomenclature

Cope 1880-3	Revised 1915
Boöchærus humerosus	= ? Dæodon humerosus

FIGS. 1-5. *Boöchærus* (= ? *Dæodon*) *humerosus* Cope, 1879. Type specimen. No. 7380, Amer. Mus. Cope Coll. From Upper Oligocene, John Day formation, upper bed, John Day Valley, Oregon. One-third natural size.

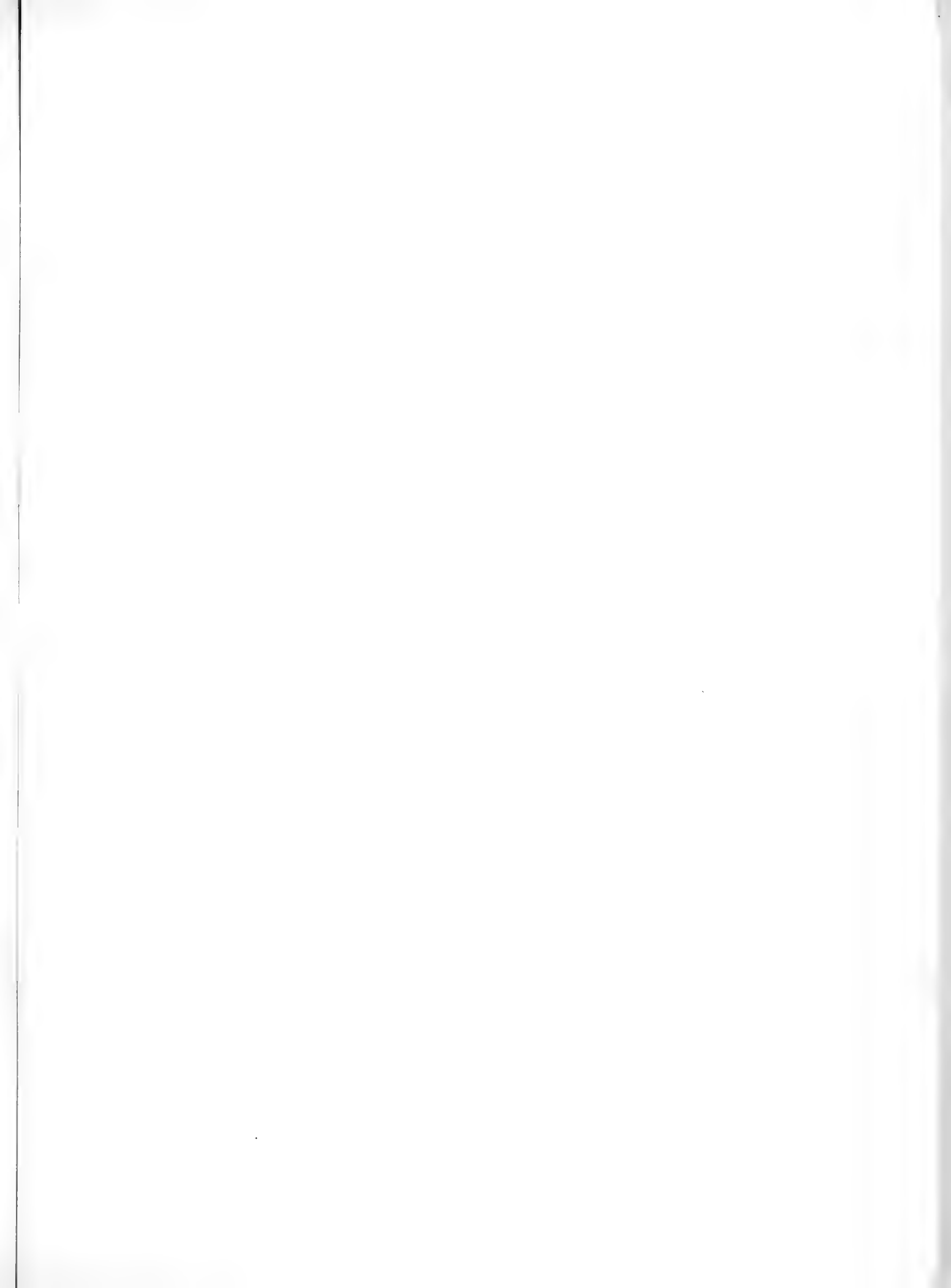
Fig. 1, 1a, 1b, 1c, humerus, posterior, anterior, proximal and distal views.

Fig. 2, 2a, 2b, distal end of radius, anterior, distal and posterior views.

Fig. 3, 3a, 3c, carpus, dorsal, proximal and internal views.

Fig. 4, 4c, manus, dorsal and internal views.

Fig. 5, 5a, 5b, 5c, femur, posterior, anterior, proximal and distal views.



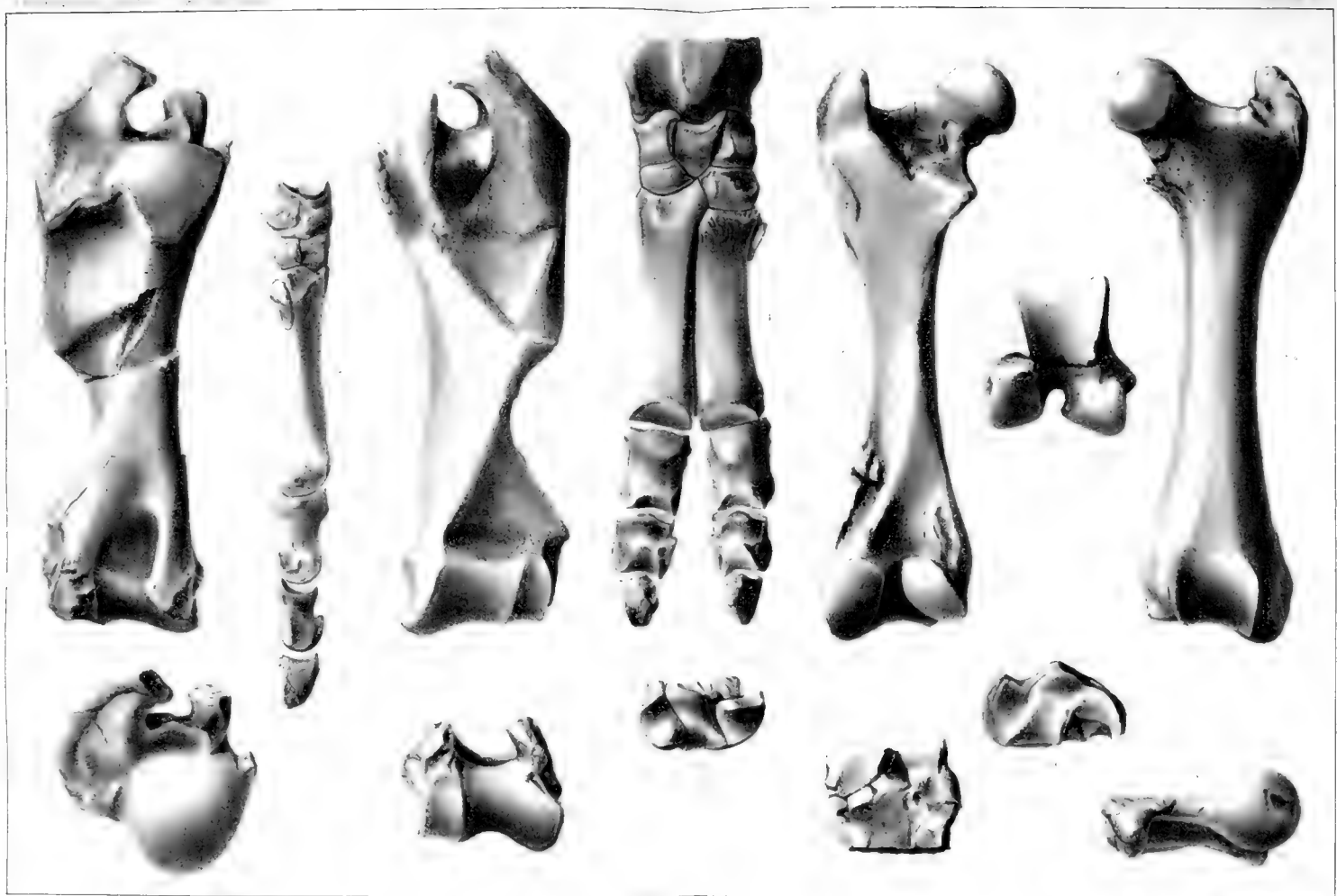


PLATE CXa.

SKULLS OF JOHN DAY DICOTYLIDÆ

Nomenclature

Cope 1880-3	Revised, 1913
Palæochærus subæquans	Perchærus subæquans
Palæochærus trichænus	Perchærus trichænus
Chænohyus deccdens	Chænohyus deccdens

- FIG. 1. *Perchærus subæquans* (Cope) 1879. Skull and lower jaw. Type specimen, Condon Coll., University of Oregon. Three-fourths natural size.
- FIG. 2. *Perchærus trichænus* (Cope) 1879. Upper jaw of type specimen, Amer. Mus. No. 7390, Cope Coll., John Day formation, Oregon. Three-fourths natural size.
- FIG. 3. *Chænohyus deccdens* Cope 1879. Upper jaw of type specimen, Condon Coll., University of Oregon. Natural size.

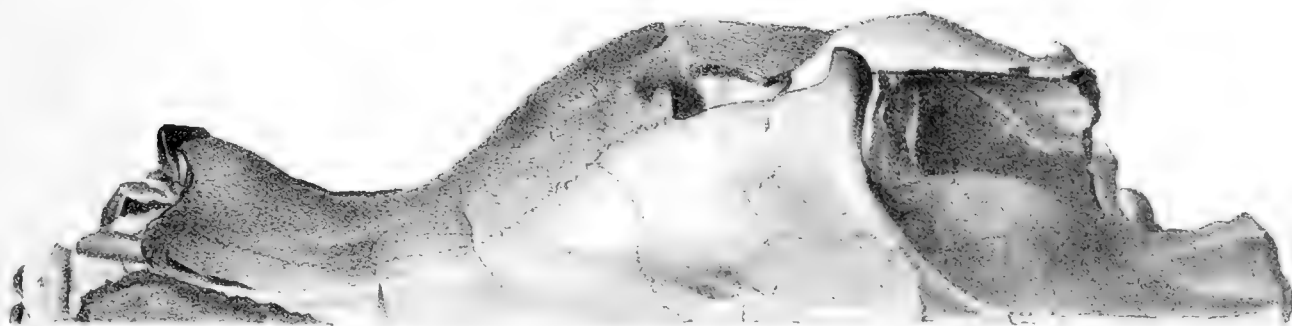
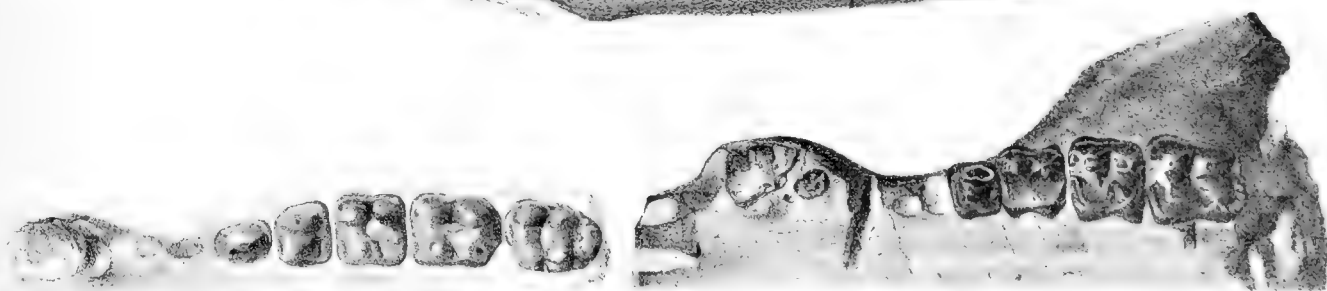
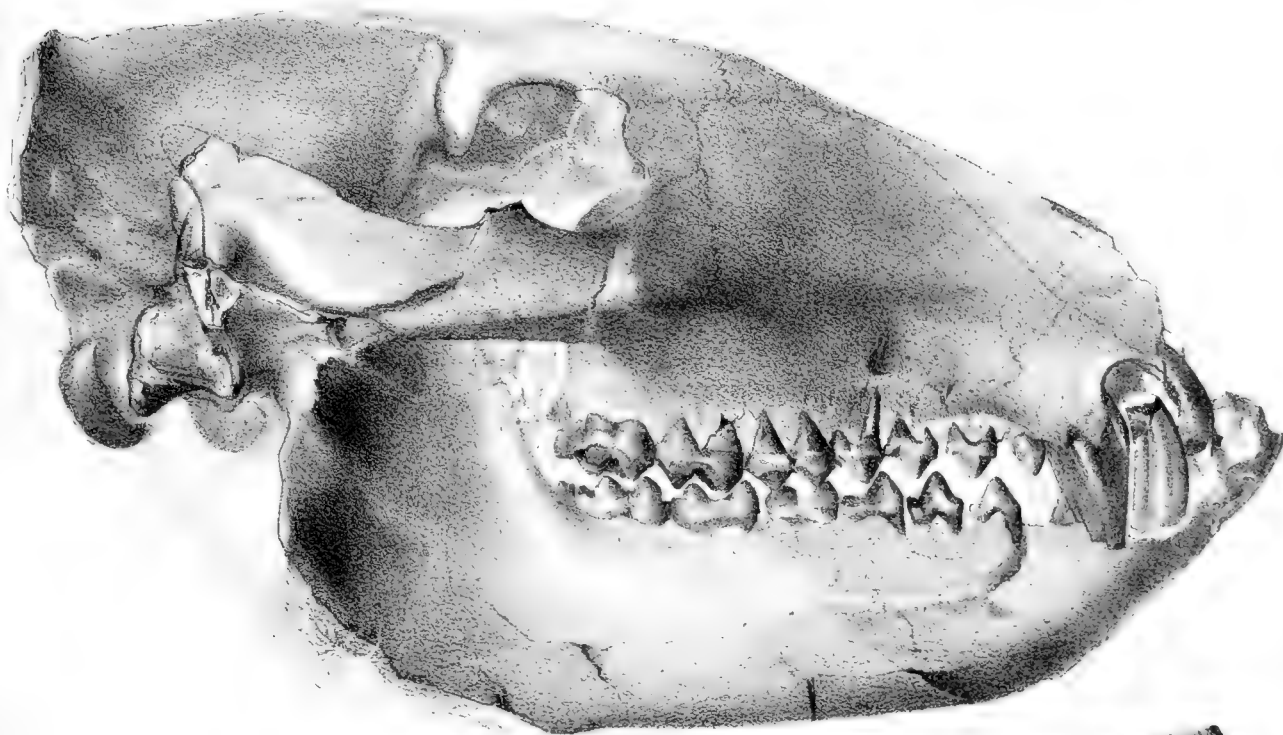


PLATE CXI.

JOHN DAY DICOTYLINES AND OREODONTS

Nomenclature

Cope 1880-3	Revised 1915
<i>Chænohyus decedens</i>	<i>Chænohyus decedens</i>
<i>Palæochærus pristinus</i>	<i>Perchærus pristinus</i>
<i>Palæochærus socialis</i>	<i>Perchærus socialis</i>
<i>Coloreodon ryderanus</i>	<i>Agriochærus ryderanus</i>

- FIG. 1, 1a. *Chænohyus decedens* Cope, 1879. Side and top views of anterior half of skull. Type specimen, Condon Coll., University of Oregon. See pl. CXa, fig. 3. Natural size.
- FIG. 2. *Perchærus pristinus* (Leidy 1873). Lower jaw, Am. Mus. No. 7392, Cope Coll. Natural size.
- FIG. 3. *Perchærus socialis* (Marsh, 1875). Lower jaw, Am. Mus. No. 7393, Cope Coll. Natural size.
- FIG. 4. *Agriochærus ryderanus* (Cope, 1881). Skull, type specimen, Am. Mus. No. 7407, Cope Coll. side view, natural size. Figs. 4a, 4b, superior and inferior views, three-fourths natural size.

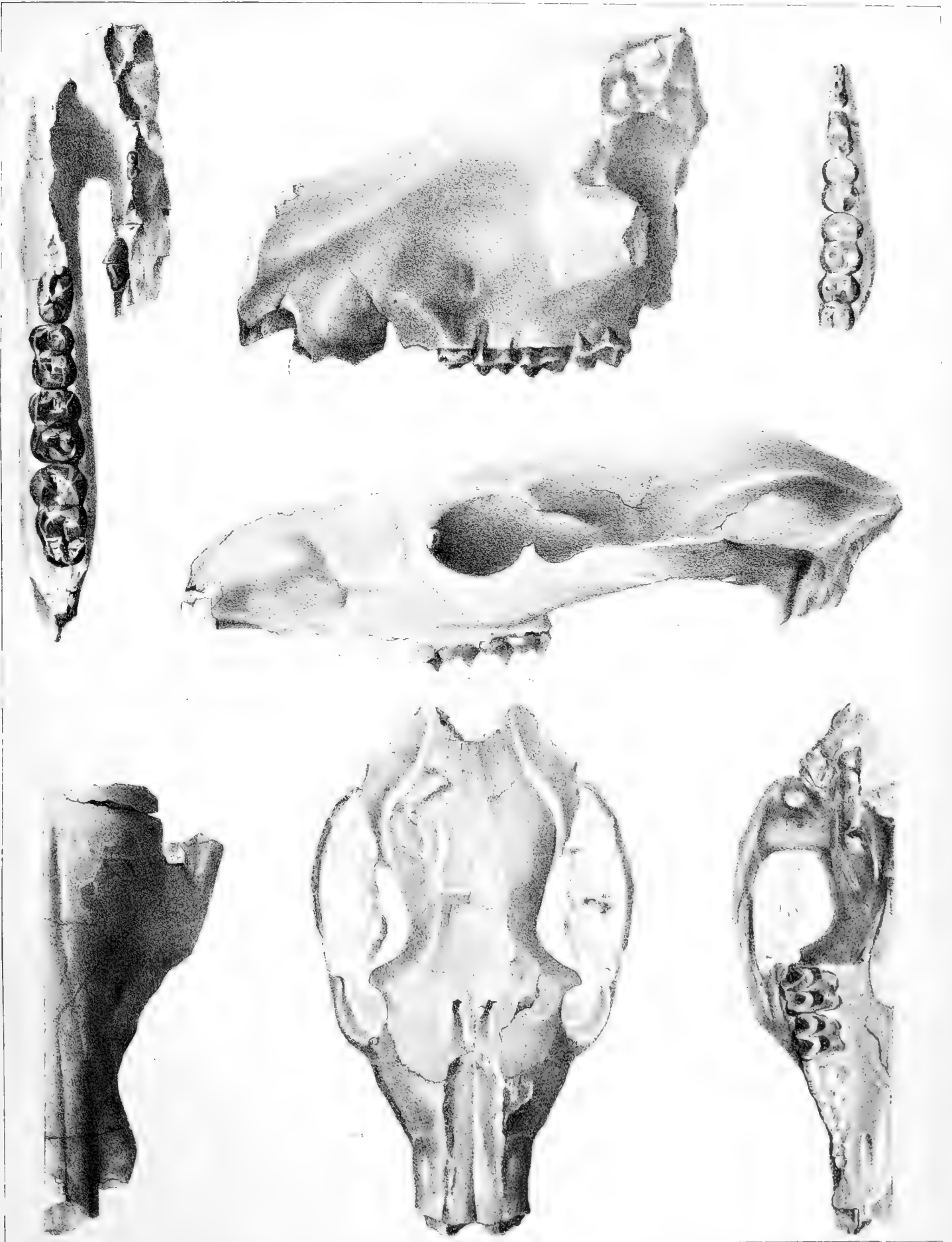


PLATE CXII.

OLIGOCENE OREODONTS. SKULL OF AGRIOCHÆRUS

Nomenclature

Cope 1880-3	Revised 1913
Agriochærus guiotianus	Agriochærus guyotianus

FIGS. 1-2. *Agriochærus guyotianus* (Cope, 1873). Skull and jaws, lateral, inferior and posterior views, natural size. Specimen figured on pl. cxiii. Amer. Mus. No. 7402, Cope Coll., John Day formation of Oregon.



PLATE CXIII.

OLIGOCENE OREODONTS. SKULLS OF AGRIOCHÆRUS

Nomenclature

Cope 1880-3

Revised 1915

Agriochærus guyotianus

Agriochærus guyotianus

Coloreodon macrocephalus

Agriochærus macrocephalus

- FIGS. 1-2. *Agriochærus guyotianus* (Cope, 1878). Skull and jaws, superior and anterior views, natural size. Specimen figured on pl. cxii. Amer. Mus. No. 7402, Cope Coll., John Day formation of Oregon.
- FIGS. 3-4. *Agriochærus macrocephalus* (Cope, 1884). Skull, superior and palatal views, natural size. Type specimen, Amer. Mus. No. 7412, Cope Coll., John Day formation of Oregon.



PLATE CXIIIa.

OLIGOCENE OREODONTS. SKULL OF AGRIOCHÆRUS

Nomenclature

Cope 1880-3	Revised 1915
Coloreodon ferox	Agriochærus ferox

FIGS. 1-3. *Agriochærus ferox* (Cope, 1879). Skull, lateral, palatal and superior views, natural size. Type specimen, Amer. Mus. No. 7413, Cope Coll., John Day formation, North Fork of John Day River, Oregon.

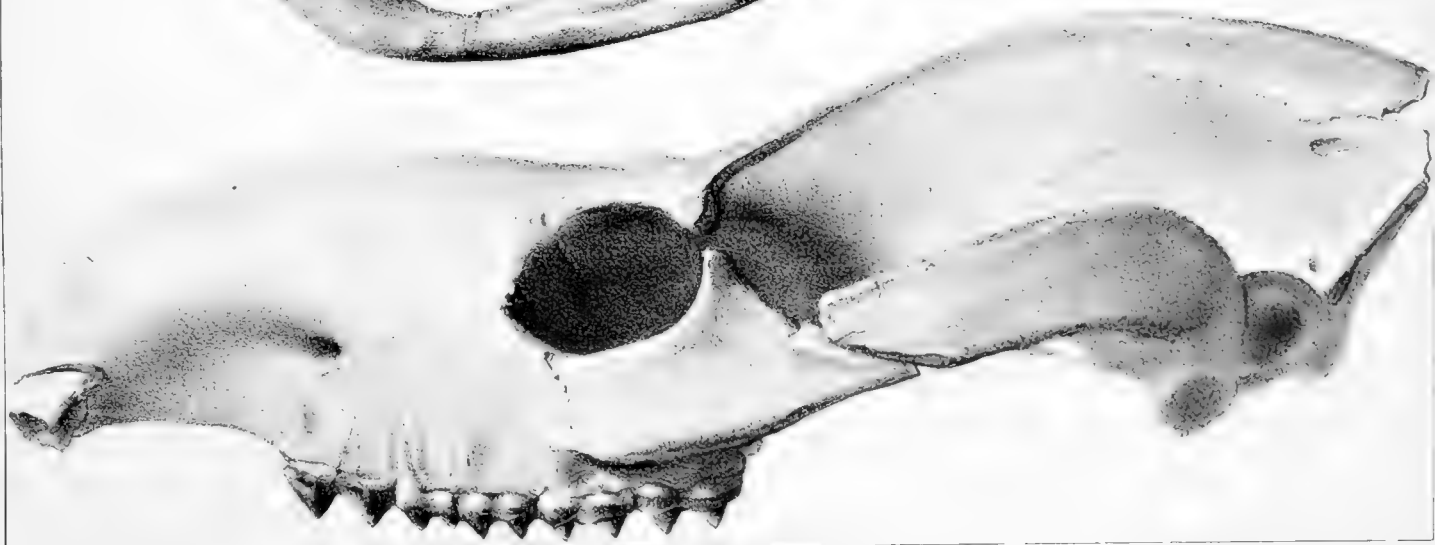
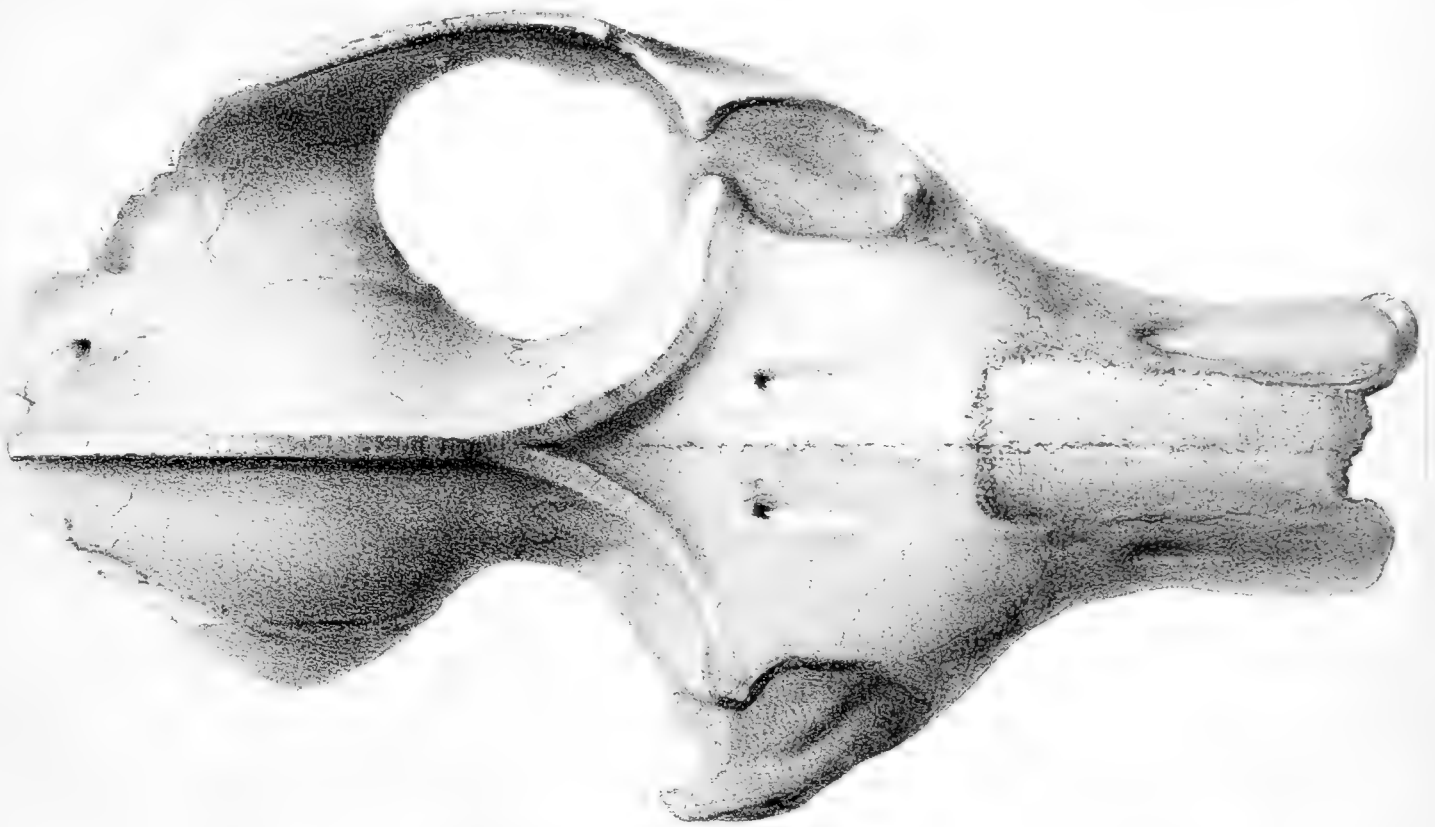


PLATE CXV.

WHITE RIVER CAMELIDÆ. SKULL AND SKELETON OF POËBROTHERIUM.

FIGS. 1-13. *Poëbrotherium labiatum* Cope, 1881. Skull, lower jaw and cervical and dorsal vertebrae of type specimen, Amer. Mus. No. 6520, Cope Coll. From Cedar Creek beds (Oreodon zone) of White River formation, head of Cedar Creek, Logan Co., Colorado. Three-fifths natural size.

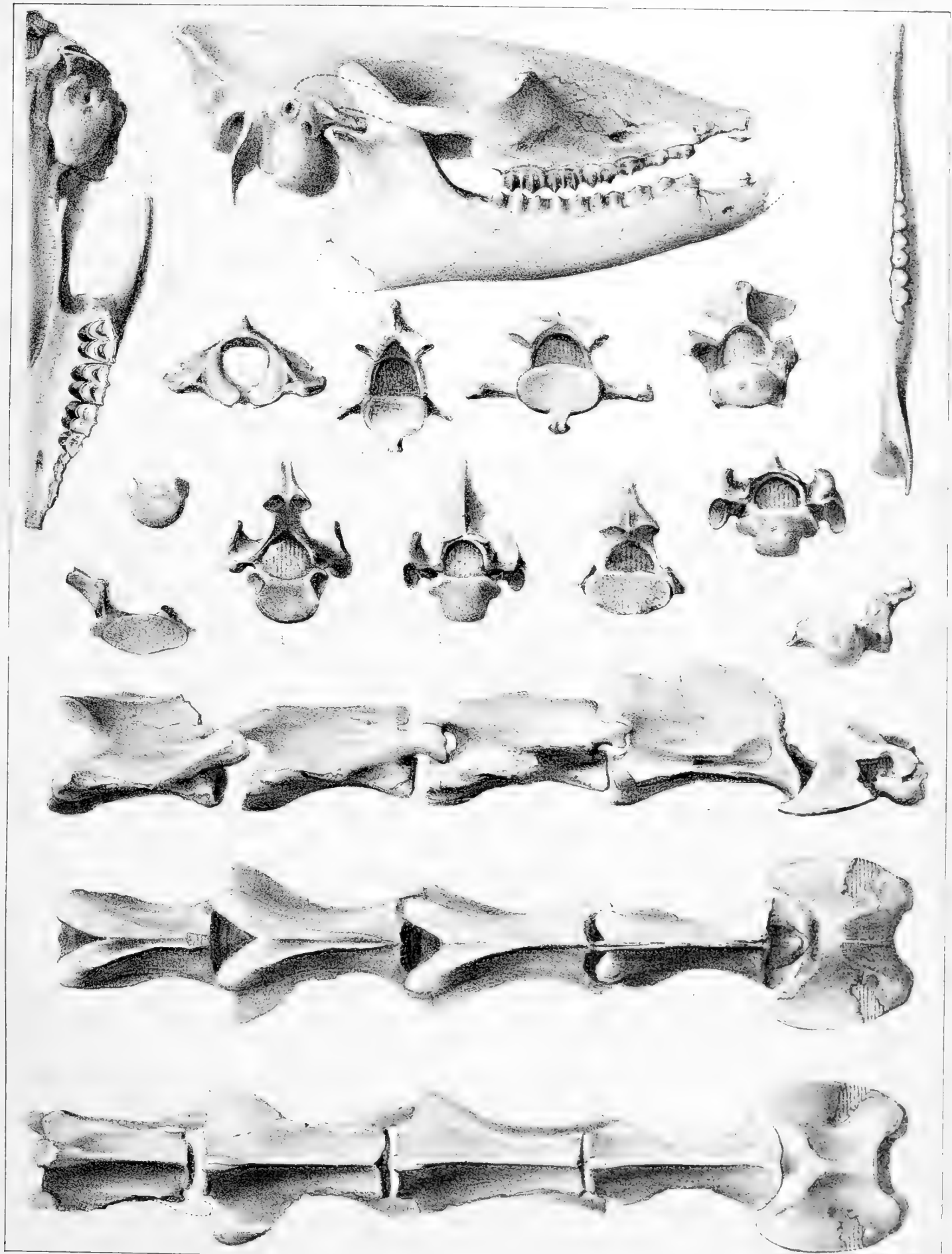


PLATE CXVa.

WHITE RIVER CAMELIDÆ. SKELETON OF POËBROTHERIUM

- FIGS. 1-12. *Poëbrotherium labiatum* Cope, 1881. Limb bones, hind foot and vertebræ of type specimen, Amer. Mus. No. 6520, Cope Coll. Cedar Creek beds, White River formation, northeastern Colorado. Three-fifths natural size. See Pl. CXV.
- FIGS. 13-21. *Poëbrotherium wilsoni* Leidy, 1847. Lower jaw, limb bones, fore-foot, and vertebræ of Amer. Mus. No. 6519, Cope Coll., Cedar Creek beds, White River formation, northeastern Colorado.

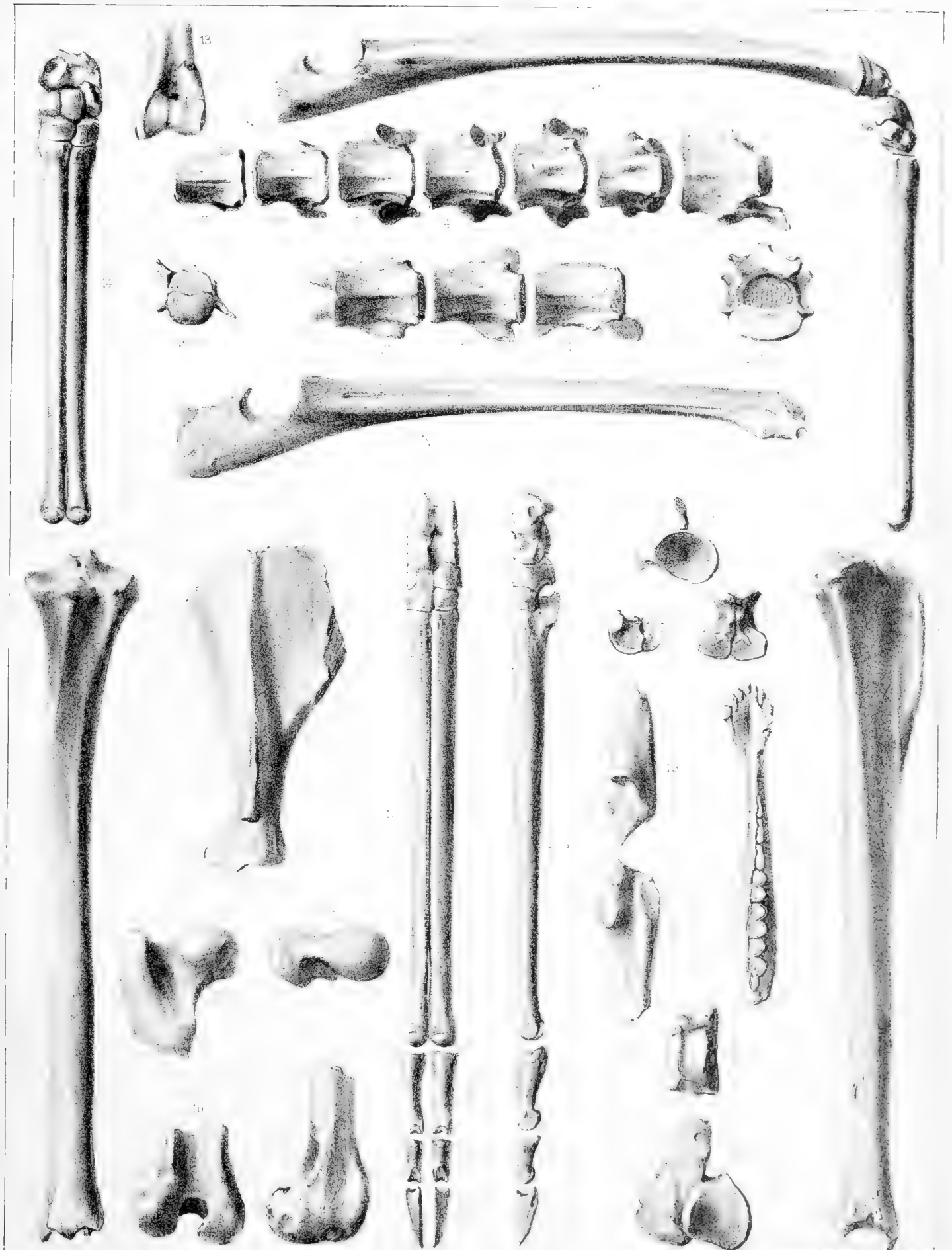


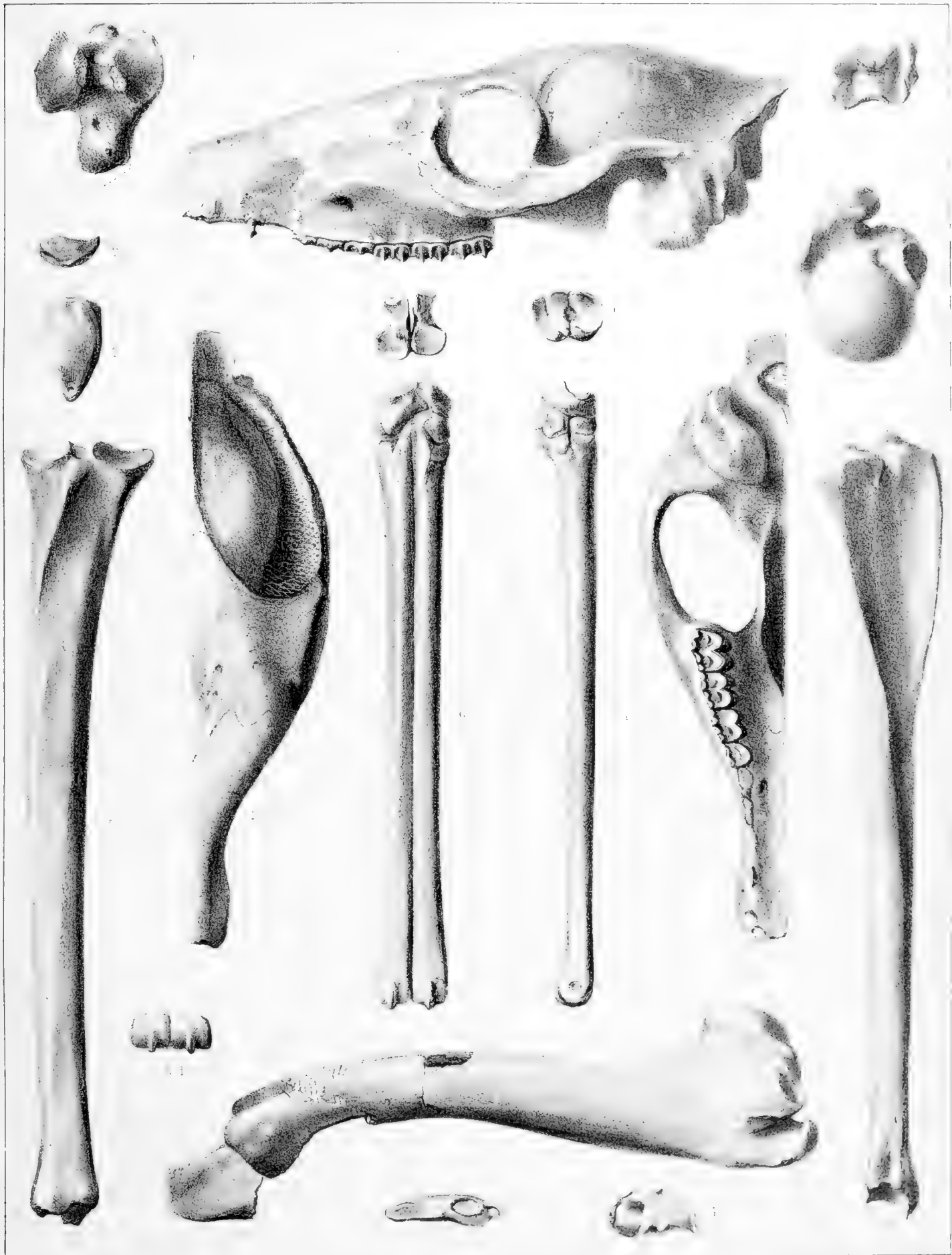
PLATE CXVI.

OLIGOCENE CAMELIDÆ. SKELETON OF PARATYLOPUS

Nomenclature

Cope 1880-3	Revised 1915
Poebrotherium sternbergi	Paratylopus sternbergi

FIGS. 1-7. *Paratylopus sternbergi* (Cope, 1879). Skull and parts of skeleton, three-fifths natural size. Type specimen, Amer. Mus. No. 7910, upper bed of John Day formation of Oregon. Figs. 1, 1a, 1b, skull, lateral, superior and palatal views; fig. 2, premaxilla, inferior view; fig. 3, 3a, humerus, external and proximal views; fig. 4, distal end of radius; fig. 5, 5a, 5b, 5c, tibia, posterior, external, proximal and distal views; 6, 6a, metatarsus with distal tarsals, posterior and internal views; 6b, proximal view of distal tarsals, 6c, of metatarsus; 6d, distal ends of metatarsals; fig. 7, 7a, patella, anterior and superior views.



PORPOIS (PORPOISE)

PLATE CXVIII.

MIocene CANIDÆ. SKULL OF ÆLURODON

Ælurodon savus (Leidy, 1858). From the skeleton Am. Mus. No. 8305, Cope Coll. Upper Miocene, Driftwood Creek, Hitchcock Co., Nebraska. Three-fourths natural size.

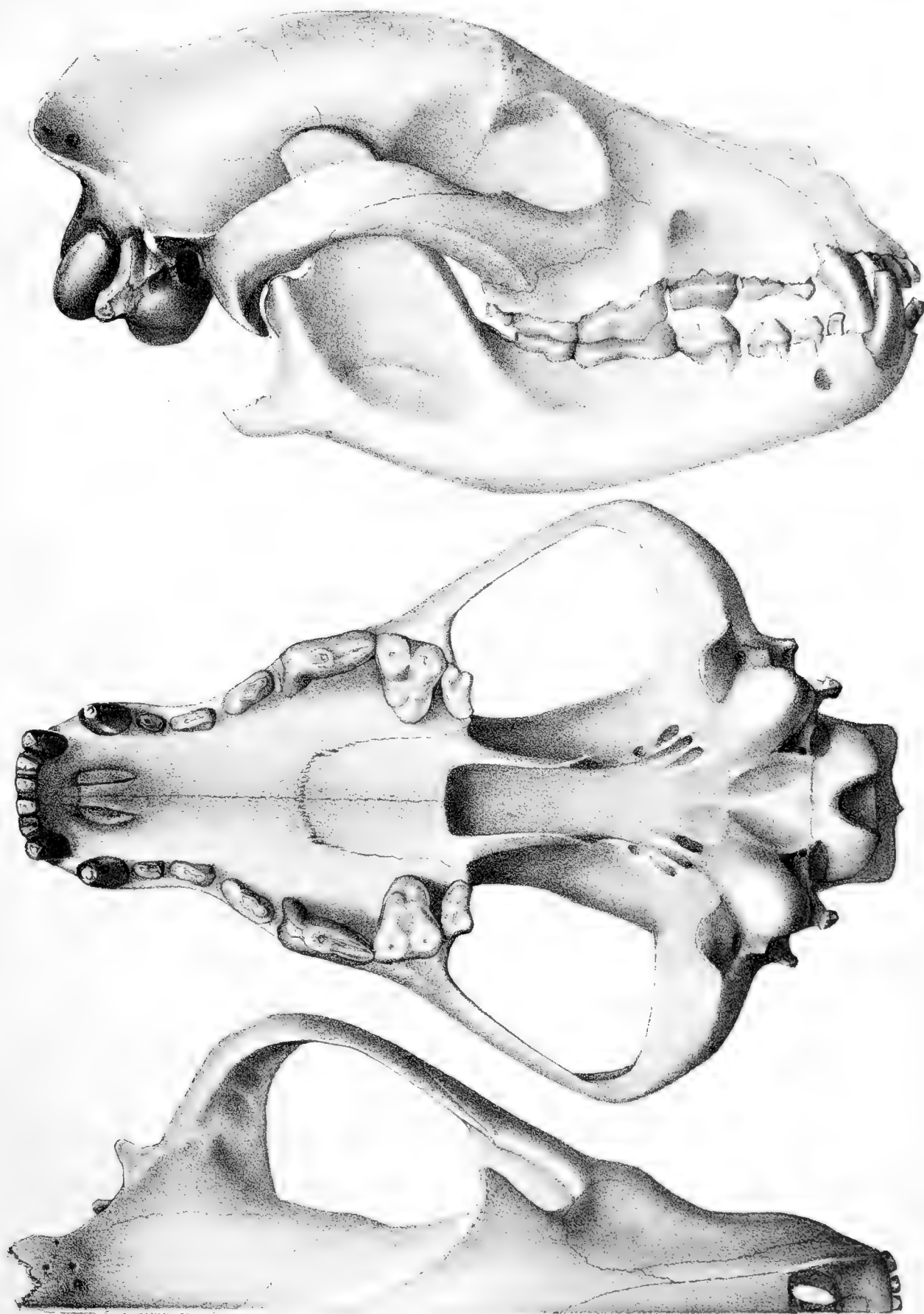


PLATE CXVIIIa.

MIOCENE CANIDÆ. SKELETON OF ÆLURODON

FIGS. 1-16. *Ælurodon sœvus* (Leidy, 1858). Vertebrae of skeleton figured on pll. CXVIII, CXVIIIb, CXIX. Fig. 1, posterior cervical; figs. 2 to 8, dorsal; figs. 9-15, lumbar vertebrae; fig. 16, pelvis and anterior caudals; figs. 17-19, distal caudal vertebrae.

All three-fourths natural size. Republican River beds, Driftwood Creek, Nebraska. Amer. Mus. No. 8305, Cope Collection.

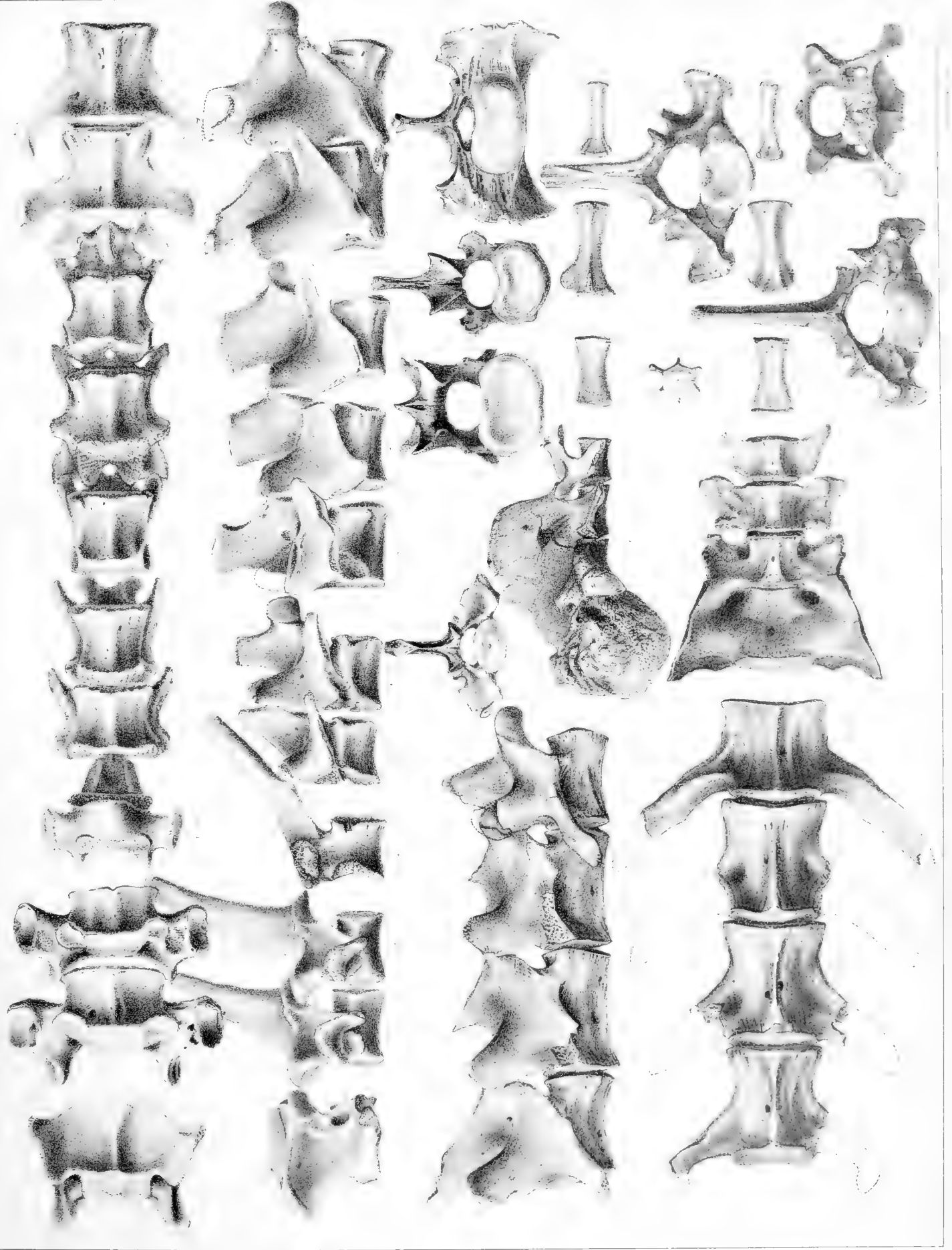


PLATE CXVIIIb.

MIocene CANIDÆ. SKELETON OF *ÆLURODON*

FIGS. 1-7. *Ælurodon savus* (Leidy, 1858). Parts of skeleton figured on pll. CXVIII, CXVIIIa, CXIX. Figs. 1, 1a, 1b, scapula, external, posterior and proximal views; figs. 2, 2a, ulna, external and anterior views; figs. 3, 3a, 3b, 3c, radius, anterior, internal, proximal and distal views; figs. 4, 4a, 4b, 4c, second metacarpal, anterior, external, internal and proximal views; fig. 5, 5a, 5b, 5c, 5d, fifth metacarpal, anterior, external, internal, proximal and distal views; fig. 6, 6a, pelvis, right side, inferior and external views; fig. 7, 7a, 7b, astragalus and calcaneum, internal, external and distal views. All three-fourths natural size. From the Republican River beds, Driftwood Creek, Nebraska, American Museum No. 8305. Cope Collection.

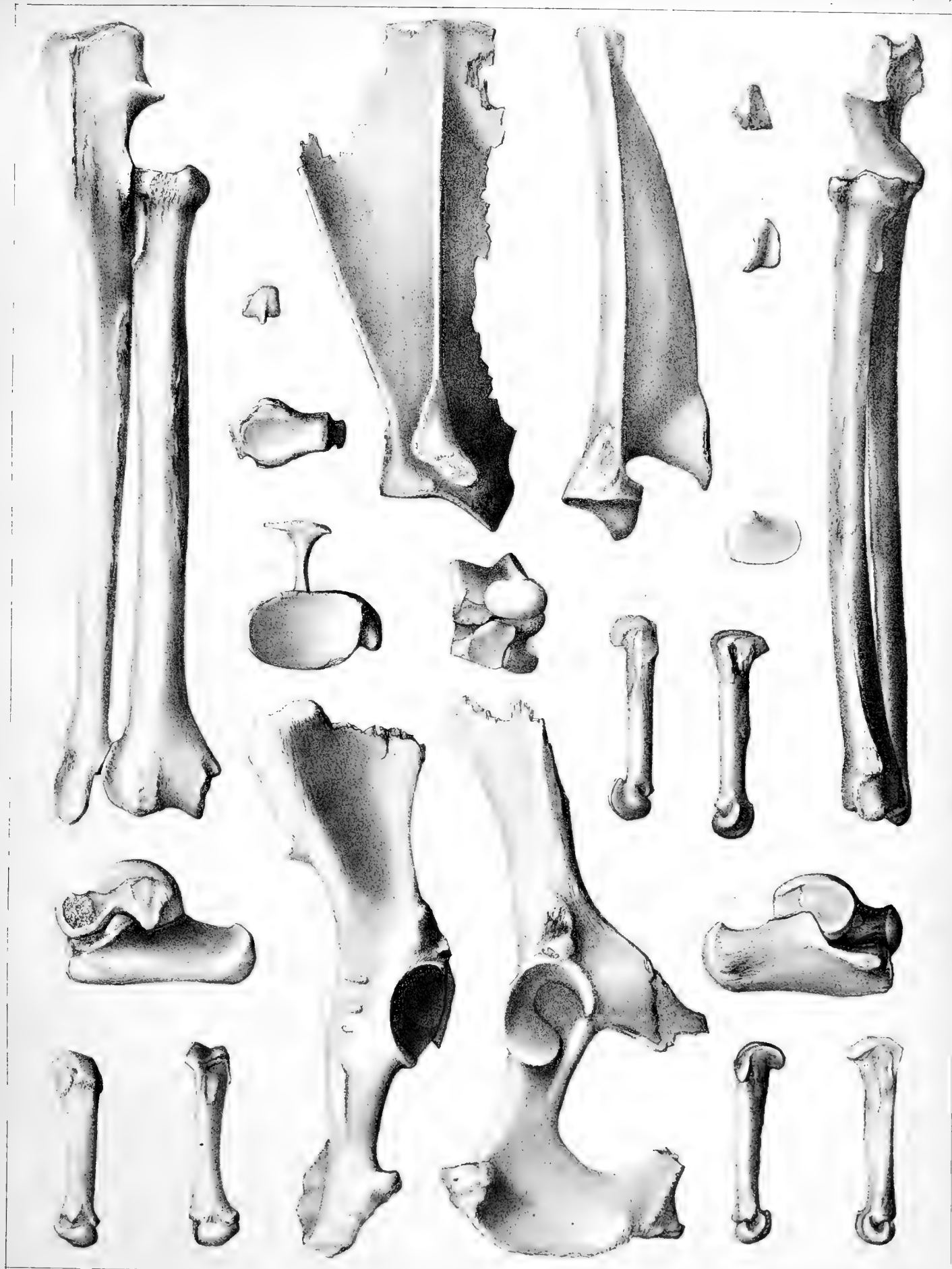


PLATE CXIX.

MIocene CANIDÆ. SKELETON OF *ÆLURODON*

FIGS. 1-8. *Ælurodon sævus* (Leidy, 1858). Parts of skeleton figured on pl. CXVIII, CXVIIIa, CXVIIIb. Fig. 1, 1a, 1b, femur, anterior, posterior and internal views; fig. 2, 2c, tibia and fibula, anterior view and distal view of tibia; fig. 3, astragalus and calcaneum, anterior view; figs. 4, 5, 6, metatarsal bones, third, fourth and fifth, dorsal internal and external views; fig. 7, proximal phalanx, and fig. 8, middle phalanx, dorsal and proximal views.

FIG. 9. *Ælurodon sævus*. Lower jaw, Amer. Mus. No. 8312, Cope Coll., superior view.

FIG. 10. ? *Ælurodon*, milk carnassial, Amer. Mus. No. 8306, Cope Coll., internal, posterior and superior views.

All specimens from the Republican River beds of Driftwood Creek, Nebraska, and figured three-fourths the natural size.

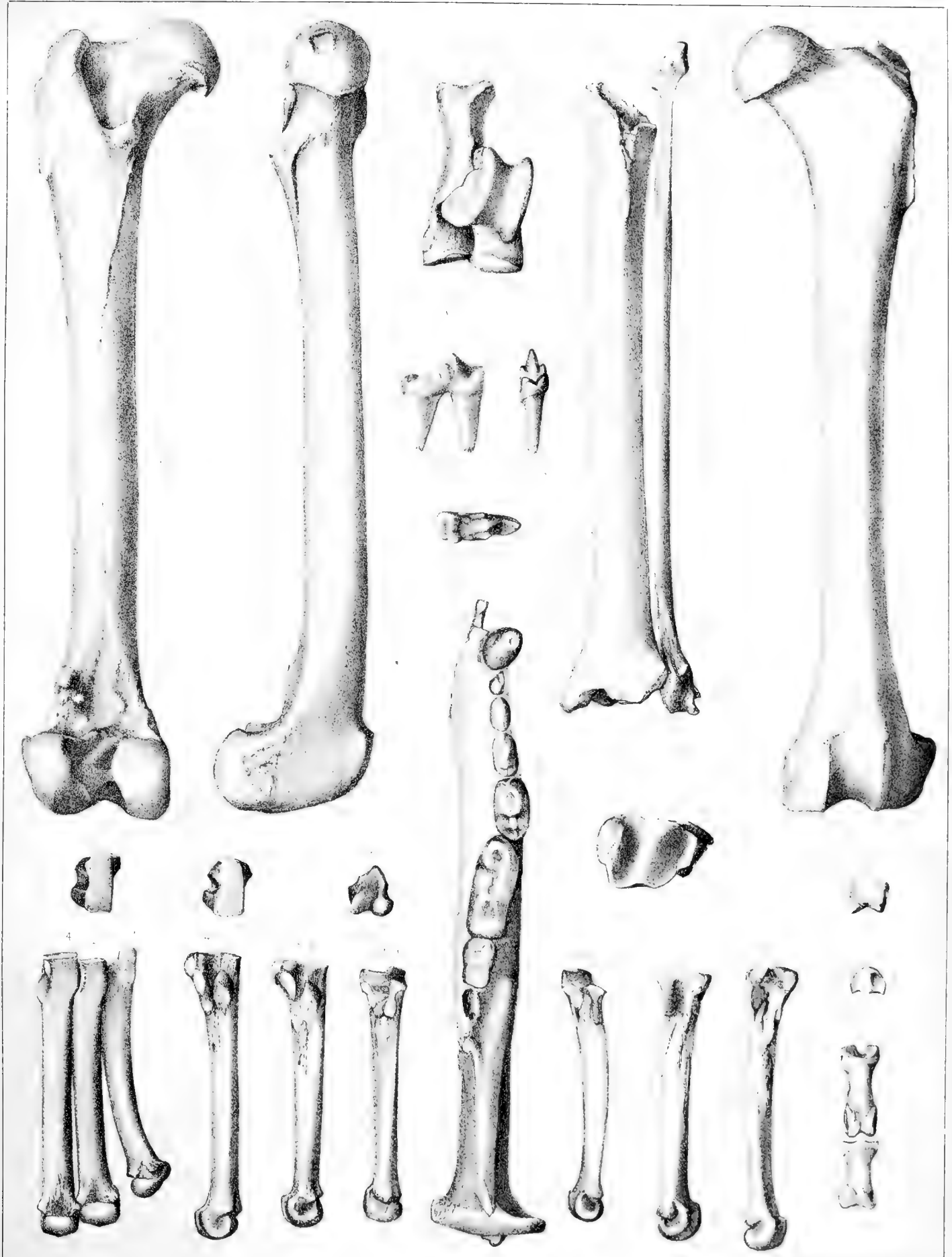


PLATE CXIXa.

JAWS AND SKELETAL PARTS OF MIOCENE CARNIVORA

Nomenclature

Cope 1880-3	Revised 1915
<i>Elurodon wheelerianus</i>	<i>Elurodon wheelerianus</i>
<i>Elurodon hyænoides</i>	? <i>Brachypsalis hyænoides</i>
<i>Canis brachypus</i>	<i>Cynodesmus brachypus</i>

FIGS. 1-3. *Elurodon wheelerianus* Cope, 1874. Upper and lower jaws, Amer. Mus. No. 8307, from Republican River bed of Red Willow Co., Nebraska. About three-fifths natural size. Fig. 1, external view of upper and lower jaw; fig. 2, inferior, fig. 2a, anterior view of maxilla; fig. 3, superior view of lower jaw.

The second upper molar, not figured here, was subsequently found among the fragments and fitted to place. The first molar is incorrectly drawn. The specimen was refigured in 1904, Bull. Am. Mus. Nat. Hist., vol. XX, pp. 250-251, figs. 3 and 4.

FIG. 5. ?*Brachypsalis hyænoides* (Cope, 1881). Upper jaw, type specimen, Amer. Mus. No. 8338. Republican River bed, Driftwood Creek, Hitchcock Co., Nebraska. Natural size.

This species appears to be of Mustelid affinities as shown in the form and construction of the teeth, especially of p^4 and m^1 , although it retains a functional m^2 , as in the Canidae. It may be the upper dentition of *Brachypsalis*, which accords in the proportions of molar and premolar dentition.

FIGS. 4 & 7. *Cynodesmus brachypus*. Parts of the type skeleton figured on Pl. CXIXb. Figs. 4, 4a, superior and inferior views of axis; fig. 7, astragalus, superior, inferior and external views.

FIG. 6, unidentified.

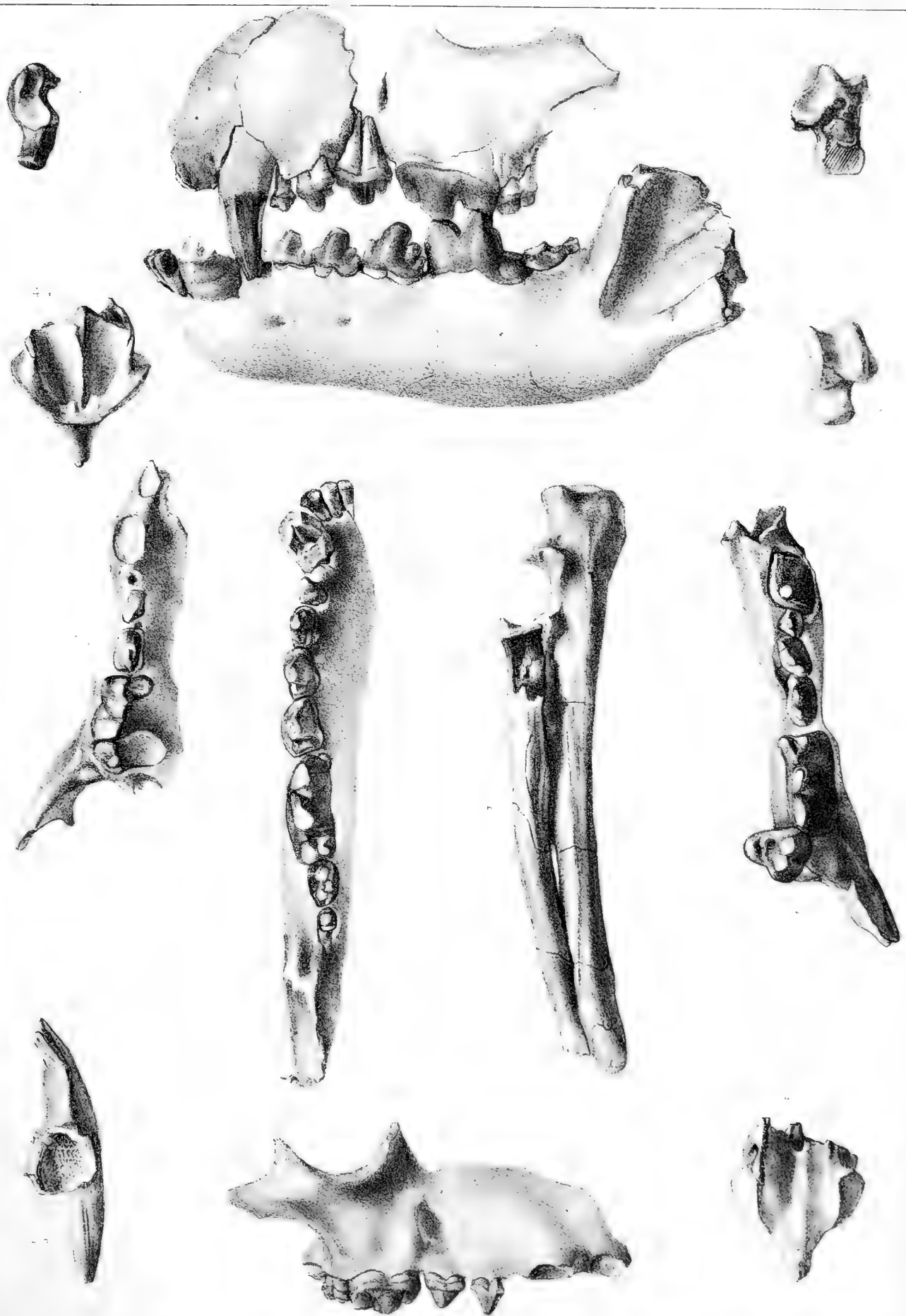


PLATE CXIX^b.

MIocene CANIDÆ. SKELETON OF CYNODESMUS

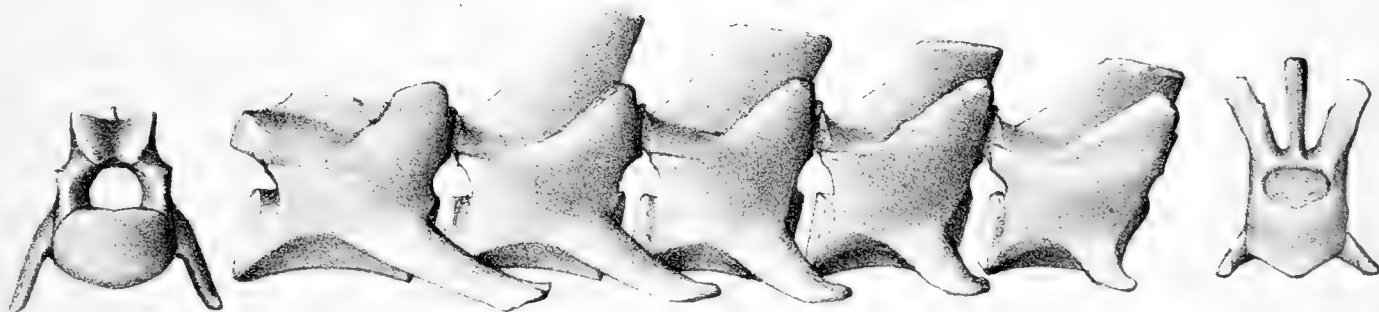
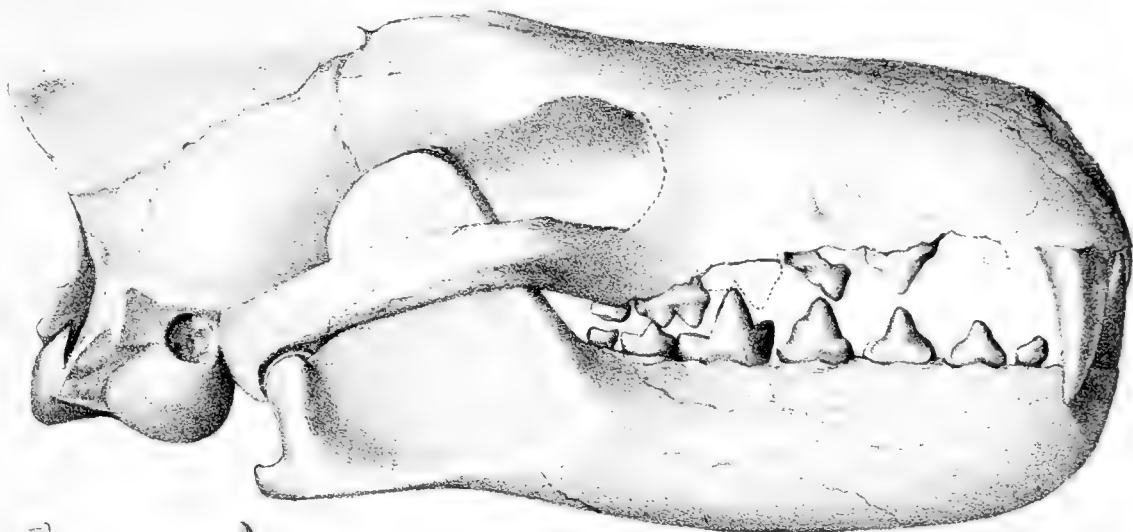
Nomenclature

Cope 1880-3	Revised 1915
<i>Canis brachypus</i>	<i>Cynodesmus brachypus</i>

FIGS. 1-9. *Cynodesmus brachypus* (Cope, 1881). Type specimen Amer. Mus. No. 8140, Cope Coll., from Miocene beds east of Laramie Peak, Wyoming. Natural size.

Fig. 1, skull and lower jaw side view; fig. 2, cervical vertebræ second to sixth; fig. 3, seventh cervical, lateral and posterior views; figs. 4, 5, 6, lumbar vertebræ; fig. 7, distal caudals; fig. 8, fifth metatarsal dorsal and plantar views; fig. 9, unidentified.

See also pl. CXIX^c and CXIX^a.



can River beds) of Driftwood Creek, Hitchcock Co., Neb. It was associated with *Mylogaulus monodon* No. 8328, *M. sesquipedalis* No. 8330 and *Eucastor tortus* No. 8333. These specimens were evidently picked up loose, and although all are weathered in much the same way, it cannot be positively stated that all are of the same geologic age. The associated specimens are characteristic species of the late Miocene and early Pliocene fauna; it is probable that the human tooth has come from some overlying Pleistocene or recent deposit and been dropped down into the older bed.

PLATE CXIXc.

MIocene CARNIVORA AND RODENTIA. HUMAN TOOTH FOUND WITH MIocene FOSSILS

Nomenclature

Cope 1880-3	Revised 1915
<i>Canis brachypus</i>	<i>Cynodesmus brachypus</i>
<i>Tomarectus brevirostris</i>	<i>Tomarectus brevirostris</i>
<i>Lutra lycopotamica</i>	? <i>Sthenictis lycopotamicus</i>
<i>Castor</i>	<i>Dipoides ?tortus</i>
<i>Mylagaulus monodon</i>	<i>Mylagaulus monodon</i>
<i>Mylagaulus sesquipedalis</i>	<i>Mylagaulus sesquipedalis</i>
<i>Palæolagus</i>	<i>Lepus</i> sp.
<i>Homo</i>	<i>Homo ?sapiens</i>

FIGS. 1-3. *Cynodesmus brachypus* (Cope, 1881). Parts of type skeleton figured on pl. CXIXb. Miocene, East of Laramie Peak, Wyo. Fig. 1, pelvis sacrum and adjoining vertebrae, side view, about three-fifths natural size; 1a ventral view of pelvis. Fig. 2, 2a, 2b, metacarpal, dorsal, external and internal views. Fig. 3, proximal phalanx, dorsal, lateral and proximal views.

FIG. 4. *Tomarectus brevirostris* Cope, 1873. Lower jaw, type specimen, Amer. Mus. No. 8302, Cope Coll., internal and superior views, natural size. Middle Miocene, Pawnee Creek beds near Pawnee Buttes, Colorado.

The systematic position of this genus is doubtful. The type is an immature jaw, the carnassial about half emerged, and the anterior part of the jaw so broken that it is not at all certain that the premolars were, as Cope considered them, reduced in number.

FIG. 5. ?*Sthenictis lycopotamica* (Cope, 1879). Lower jaw, type specimen, internal and superior views. From Pawnee Creek beds (Middle Miocene) of northeastern Colorado. The original has been lost. Professor Cope's descriptions have not sufficed to determine the affinities of this species, which he referred to *Potamogale* (*Lutricitis*=). It appears to be related to "*Stenogale*" *robusta*, Cope, which Peterson has (1910) made the type of *Sthenictis*.

FIGS. 6-9. *Dipoides* sp. Figs. 6, 6a, lower jaw, Amer. Mus. No. 8332, Cope Coll., external and superior views; Fig. 7, lower incisor, external view; Fig. 8, humerus, anterior view, Fig. 9, caudal vertebra, superior view; all natural size. Republican River beds, northwestern Kansas.

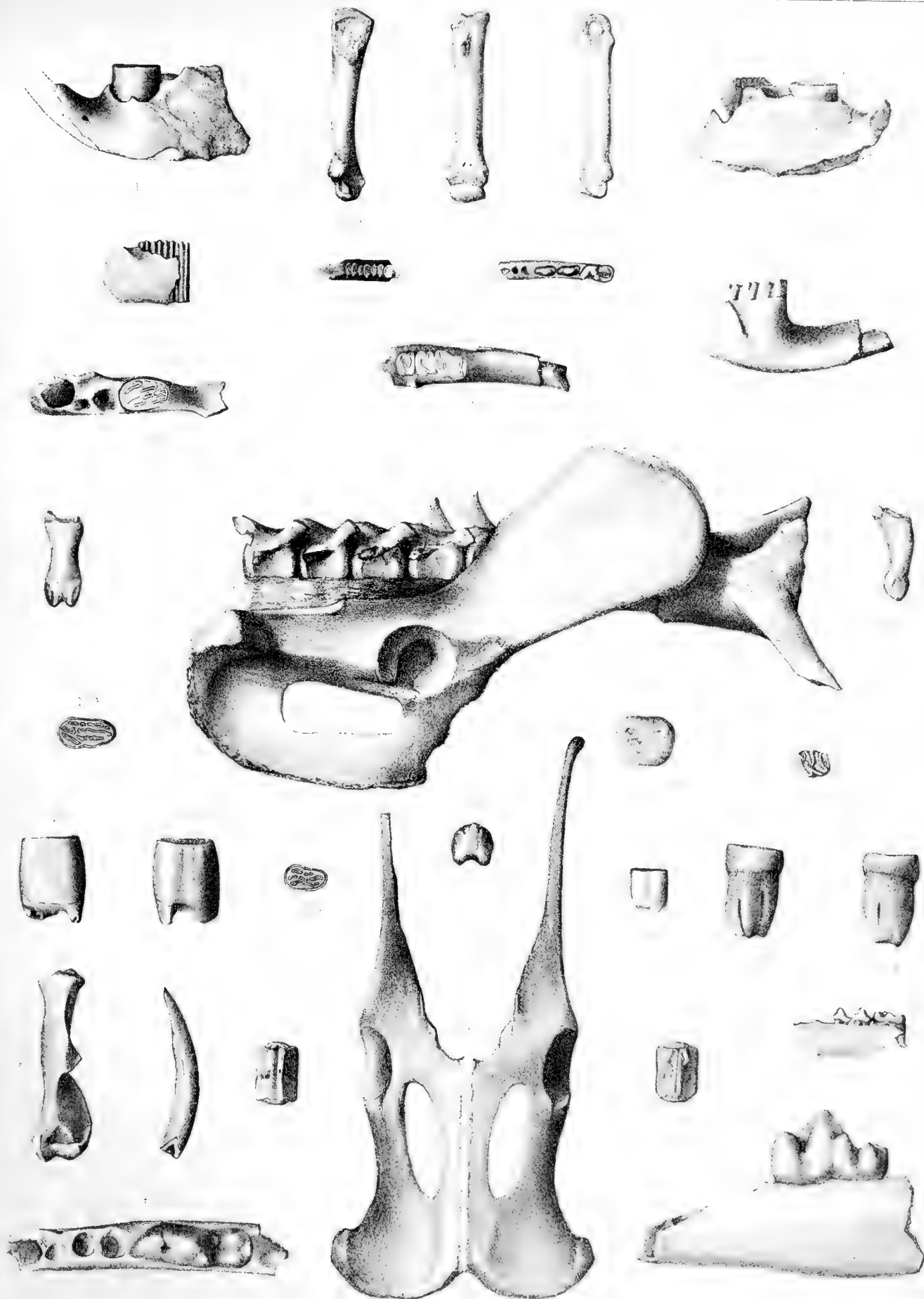
FIG. 10. *Mylagaulus monodon* Cope, 1881. Lower premolar, p. 4, Am. Mus. No. 8328, Cope Coll. Natural size. Republican River bed, Kansas.

FIG. 11. *Mylagaulus monodon* Cope, 1881. Lower jaw, type specimen, Amer. Mus. No. 8327, Cope Coll. External, internal and superior views, natural size. Republican River beds, Driftwood Creek, Hitchcock Co., Neb.

FIG. 12. *Mylagaulus sesquipedalis* Cope, 1878. Upper premolar, p. 4.

FIG. 13. *Lepus* sp. Lower jaw, Amer. Mus. No. 8335, Cope Coll. External and superior views, natural size. Republican River beds, Driftwood Creek, Hitchcock Co., Neb.

FIG. 14. *Homo ? sapiens*. Human tooth found in association with upper Miocene mammals. Amer. Mus. No. 8304, Cope Coll. Republican River beds, northwestern Kansas. This tooth was collected by Professor Cope's party on the "Loup Fork" (Republi-



1-3 CANIS BRACHYPUS. 4. TOMARCTUS BREVIROSTRIS. 5 LUTRA LYCOPOTAMICA. 6-8
10-11 MYLAGAULUS. 12-13. 14-15. 16-17. 18-19. 20-21. 22-23. 24-25. 26-27. 28-29. 30-31. 32-33. 34-35. 36-37. 38-39. 40-41. 42-43. 44-45. 46-47. 48-49. 50-51. 52-53. 54-55. 56-57. 58-59. 60-61. 62-63. 64-65. 66-67. 68-69. 70-71. 72-73. 74-75. 76-77. 78-79. 80-81. 82-83. 84-85. 86-87. 88-89. 90-91. 92-93. 94-95. 96-97. 98-99. 100-101. 102-103. 104-105. 106-107. 108-109. 110-111. 112-113. 114-115. 116-117. 118-119. 120-121. 122-123. 124-125. 126-127. 128-129. 130-131. 132-133. 134-135. 136-137. 138-139. 140-141. 142-143. 144-145. 146-147. 148-149. 150-151. 152-153. 154-155. 156-157. 158-159. 160-161. 162-163. 164-165. 166-167. 168-169. 170-171. 172-173. 174-175. 176-177. 178-179. 180-181. 182-183. 184-185. 186-187. 188-189. 190-191. 192-193. 194-195. 196-197. 198-199. 200-201. 202-203. 204-205. 206-207. 208-209. 210-211. 212-213. 214-215. 216-217. 218-219. 220-221. 222-223. 224-225. 226-227. 228-229. 230-231. 232-233. 234-235. 236-237. 238-239. 240-241. 242-243. 244-245. 246-247. 248-249. 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PLATE CXX.

MIocene PROBOSCIDEA. SKULL OF TETRALOPHODON

Nomenclature

Cope 1880-3	Revised 1915
Mastodon campester	Tetralophodon campester

Tetralophodon campester (Cope, 1878). Palatal view of skull of type specimen, Amer. Mus. No. 8527, Cope Coll. From Republican River Bed of Sappa Creek, Rawlins Co., Kansas. One-half natural size.
See also pl. CXXI, CXXII, CXXIII.

Note on the Nomenclature of Tertiary Mastodons

- Gomphotherium* Burmeister, 1837, appears to be the earliest available generic name for the four-tusked mastodons with three transverse crests on the intermediate teeth of which the type and best known species is *G. angustidens* (Cuv.) of the European Miocene. *Trilophodon* Falconer and *Tetrabelodon* Cope are based upon the same species but are of later date. *Trilophodon* is the name adopted at present for the publications of the American Museum.
- Tetralophodon* Warren, 1852, applies to the genera with four crests on the intermediate molars, *Mastodon longirostris* and *arvernensis* of Europe being the types.

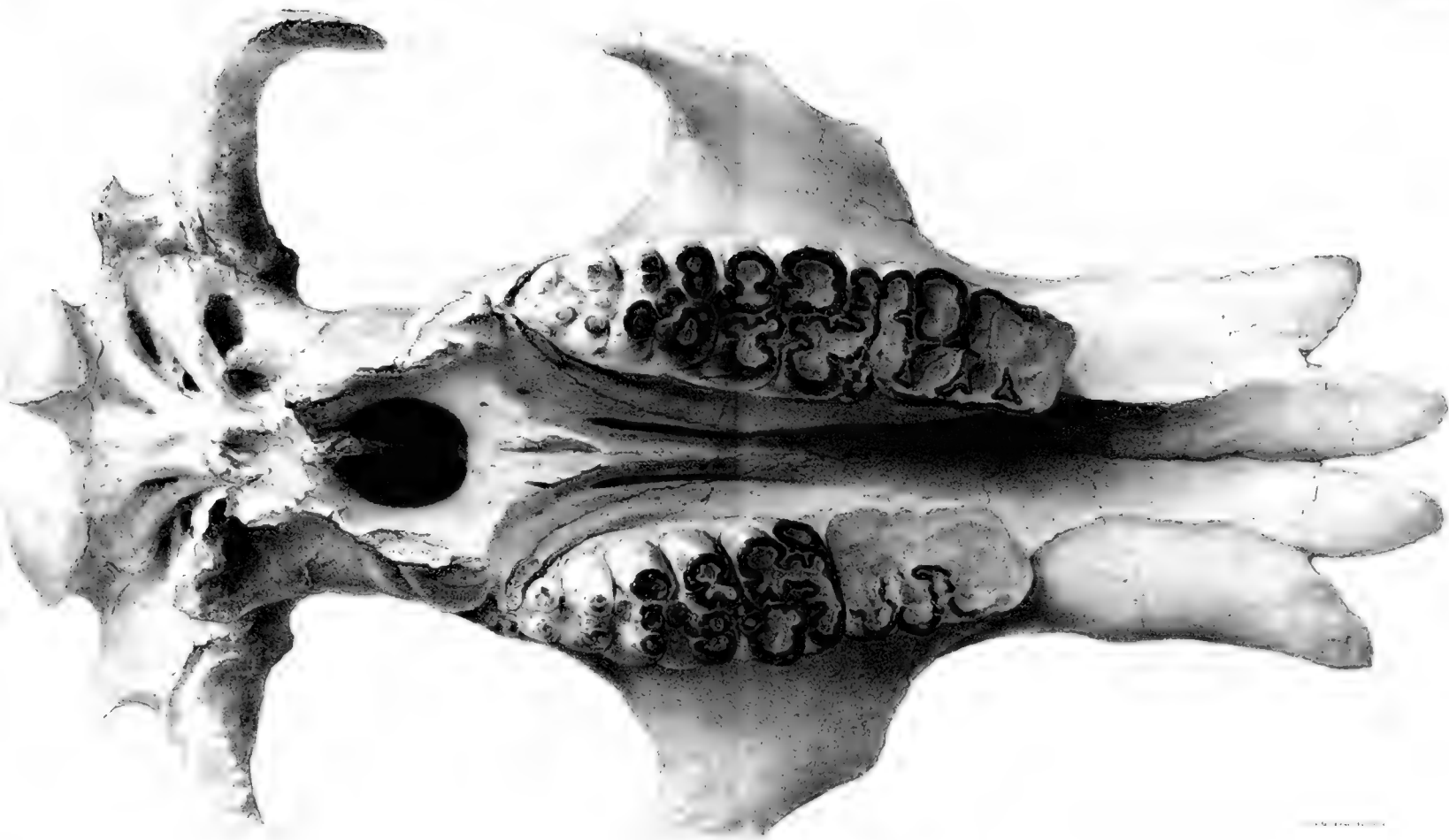


PLATE CXXI.

MIocene PROBOSCIDEA. BONES OF TETRALOPHODON

Nomenclature

Cope 1880-3	Revised 1915
Mastodon campester	Tetralophodon campester

FIGS. 1-2. *Tetralophodon campester* (Cope, 1878). Type specimen, Amer. Mus. No. 8527, Cope Coll., from Republican River beds, Sappa Creek, Kansas. Fig. 1, 1a, pelvis, inferior and external views; fig. 2, 2a, 2b, 2c, 2d, fifth metacarpal, plantar, dorsal, internal, proximal and distal views. All one-fourth natural size.
Specimen figured in pll. CXX, CXXII, CXXIII.

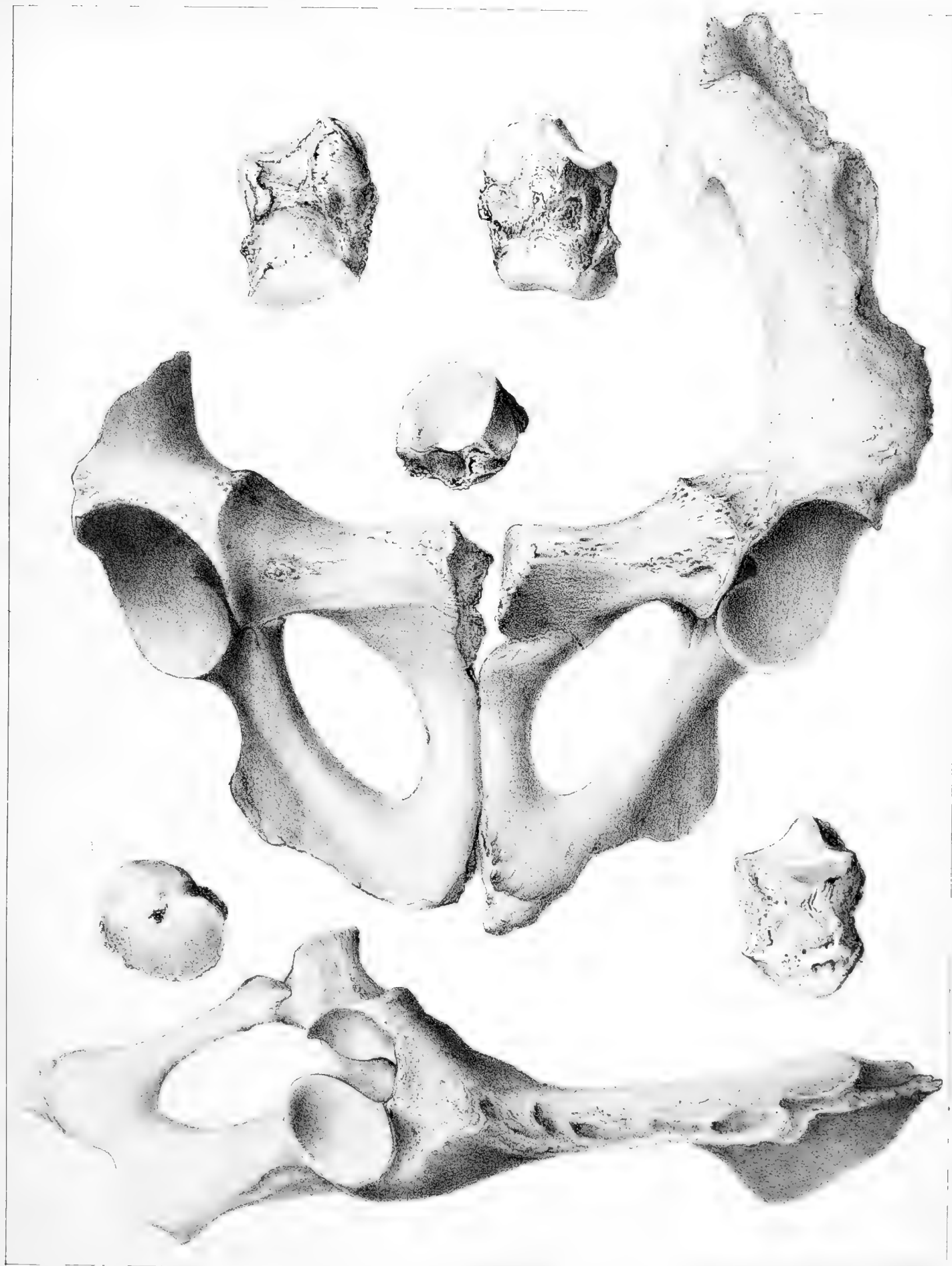


PLATE CXXII.

MIOCENE PROBOSCIDEA

Nomenclature

Cope 1880-3	Revised 1915
Mastodon campester	Tetralophodon campester
Mastodon "ligoniferus" (unpub.)	? Tetralophodon sp.

FIGS. 1-2. *Tetralophodon campester* (Cope, 1878). Part of skull and lower jaw. Type specimen, Amer. Mus. No. 8527, Cope Coll., from Republican River beds, Sappa Creek, Kansas. Fig. 1, side view of skull and jaw restored in outline; 1a, 1b, cross-sections of upper tusk; fig. 2, lower jaw, superior view. Specimen figured in pll. CXX, CXXI, CXXIII.

FIGS. 3-5. ? *Tetralophodon* sp. Lower jaw and femur, Amer. Mus. No. 8529, Republican River beds, Driftwood Creek, Hitchcock Co., Nebraska. Fig. 3, 3a, inferior and anterior views of lower jaw; fig. 5, 5a, external and distal views of femur. Specimen figured on pl. CXXIV.

All figures one-fourth natural size.

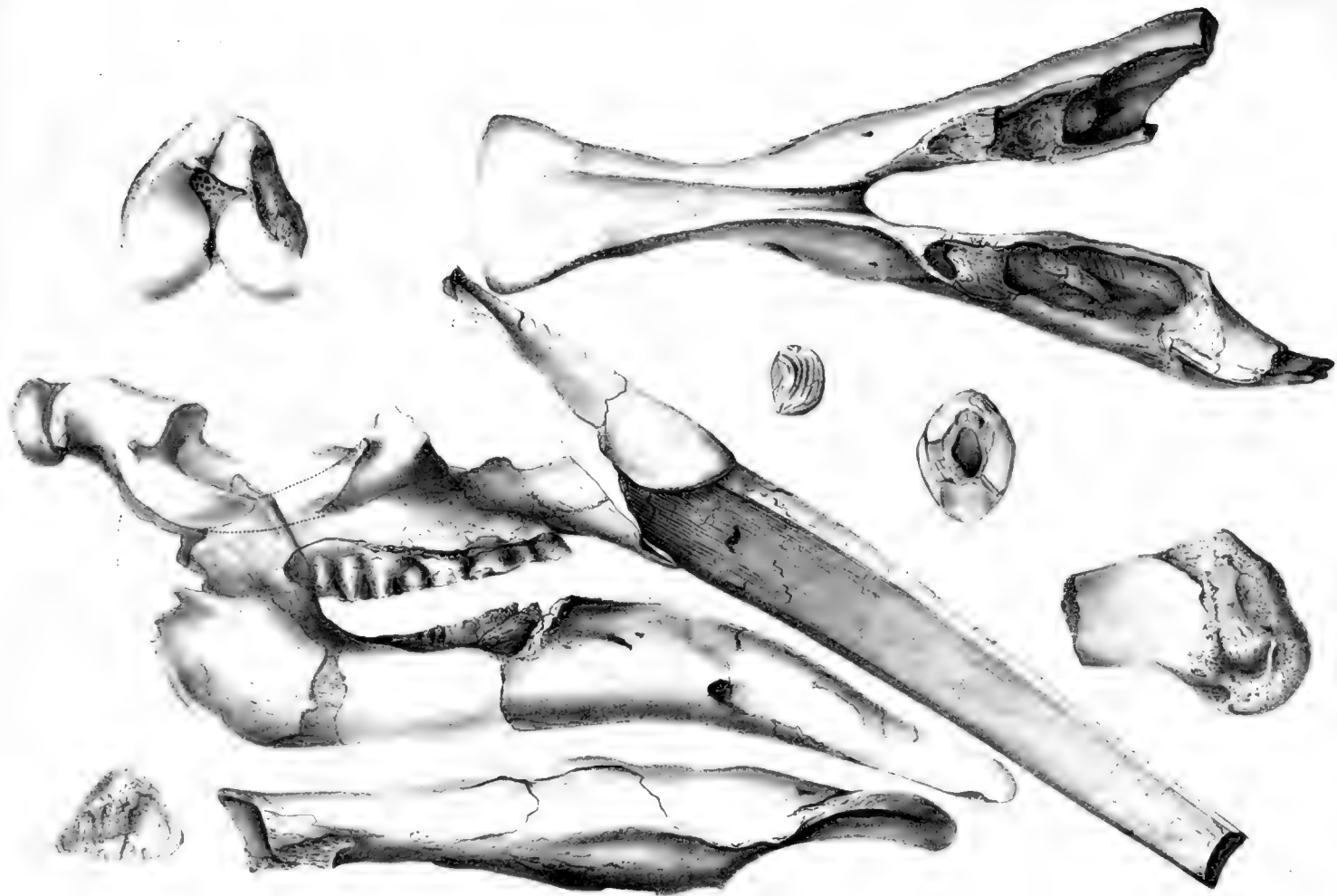


PLATE CXXIII.

MIOCENE PROBOSCIDEA

Nomenclature

Cope 1880-3	Revised 1915
Mastodon campester	Tetralophodon campester
Mastodon sp.	? Trilophodon (= Gomphotherium) sp.

- FIG. 1. *Tetralophodon campester* (Cope, 1878). Inferior view of lower jaw of type specimen, Amer. Mus. No. 8527, figured on pll. CXX-CXXII.
- FIG. 2. ? *Trilophodon* sp. Basicranial region, from below. Amer. Mus. No. 8520, Cope Coll. Republican River beds, Kansas.
- FIG. 3, 3a. ? *Trilophodon* sp. Scapula, external and proximal views. Amer. Mus. No. 8540, Cope Coll. Republican River beds, Decatur Co., Kansas.
- All figures one-fourth natural size.



PLATE CXXIV.

MIocene PROBOSCIDEA

Nomenclature

Cope 1880-3	Revised 1915
Mastodon ligoniferus	? Tetralophodon sp.

FIGS. 1-2. ? *Tetralophodon* sp. Allied to *Tetralophodon campester*. Amer. Mus. No. 8531, Cope Coll. Black Hills, S. Dakota, horizon uncertain.

FIG. 1. Lower jaw external view; fig. 2, superior view; fig. 3, ? upper molar; fig. 4, distal end of femur.

FIG. 3. ? *Tetralophodon* sp.; upper molar, ? Amer. Mus. No. 8529, Cope Coll. Republican River beds, Driftwood Creek, Nebraska. Specimen figured on pl. CXXII.

FIG. 4. ? *Tetralophodon* sp., distal end of femur of No. 8529. See pl. CXXII.

All one-fourth natural size. The name *ligoniferus* appears to be unpublished.



PLATE CXXV.

MIocene RHINOCEROSES. SKULL OF APHELOPS MEGALODUS

Aphelops megalodus Cope, 1873. Side view of skull and jaws, half natural size. Type specimen, Amer. Mus. No. 8292, Cope Coll. Pawnee Creek beds, near Pawnee Buttes, Weld Co., Colorado.

See also Pls. CXXVI-CXXX and CXXXV.

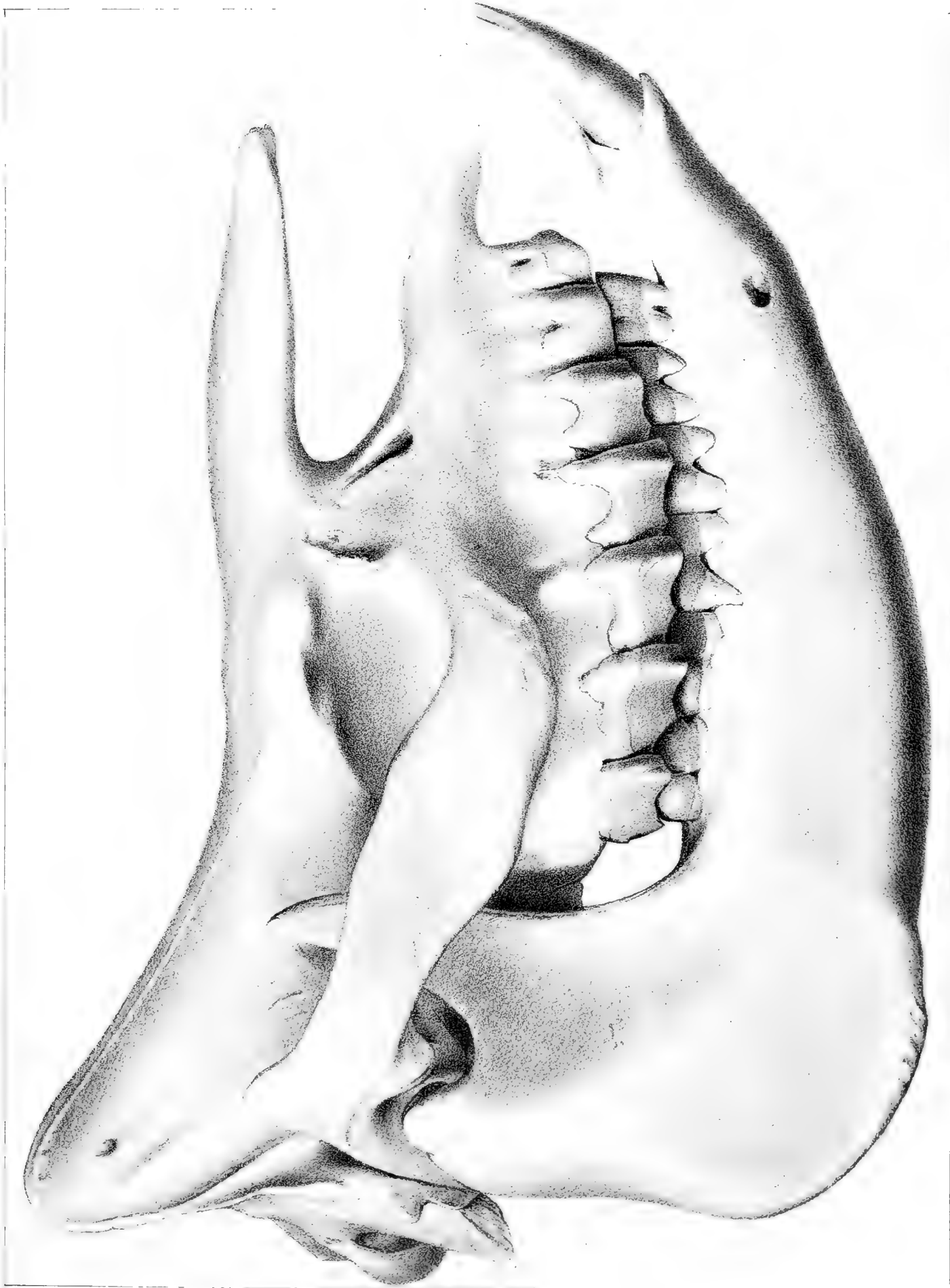


PLATE CXXVI.

MIocene RHINOCEROSSES. SKULL OF APHELOPS MEGALODUS

Aphelops megalodus Cope, 1873. Superior view of skull one-half natural size. Type specimen, figured on pl. CXXV, CXXVII-CXXX and CXXXV.



PLATE CXXVII.

MIocene RHINOCEROSSES. SKULL OF APHELOPS MEGALODUS

Aphelops megalodus (Cope, 1873). Inferior view of skull, one-half natural size. Type specimen, figured on pll. CXXV-CXXVI, CXXIX-CXXX and CXXXV.

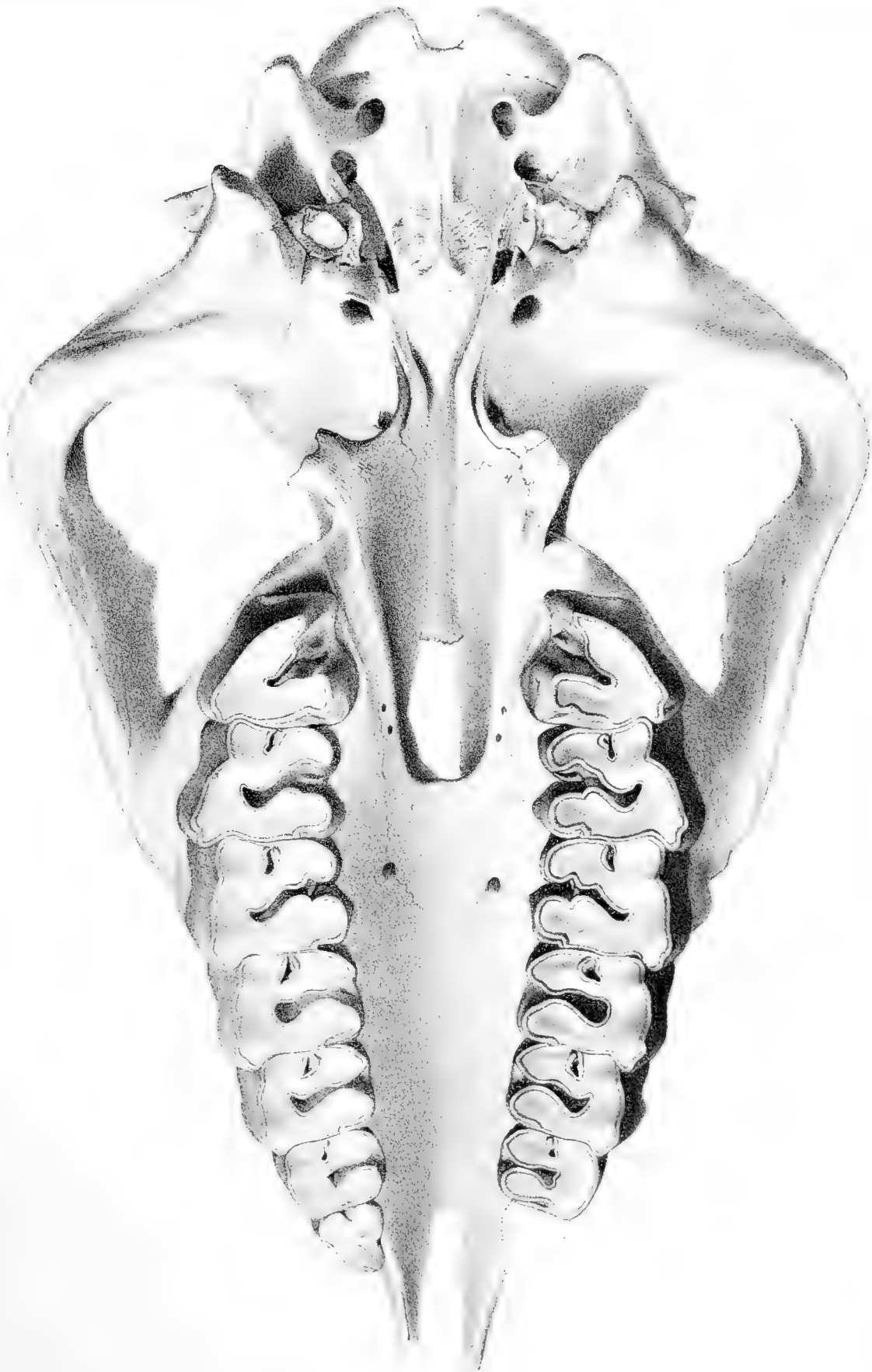


PLATE CXXIX.

MIocene RHINOCEROSSES. VERTEBRÆ OF APHELOPS

FIGS. 1-4. *Aphelops megalodus* (Cope, 1873). Cervical vertebræ, two-fifths natural size. Type specimen, No. 8292, from Pawnee Creek beds, near Pawnee Buttes, Weld Co., Colorado.

Fig. 1, 1a. Atlas, lateral and inferior views; fig. 2, 2a, 2c, axis, lateral, inferior and posterior views; fig. 3, 3a, 3b, third, cervical vertebra, lateral, inferior and anterior views; fig. 4, 4a, 4b, 4c, fourth cervical vertebra, lateral, inferior, anterior and posterior views.

FIG. 5, 5a. *Aphelops megalodus* (Cope, 1873). Distal end of ulna, paratype, No. 8293, figured on pl. CXXX.

FIGS. 6-7. *Aphelops megalodus* (Cope, 1873). No. 8293a, specimen figured on pl. CXXX, proximal views of metacarpals.

All figures two-fifths natural size.

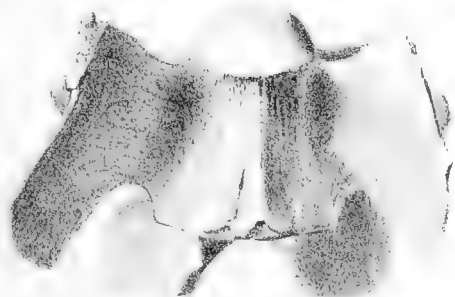
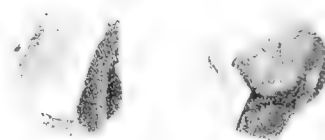
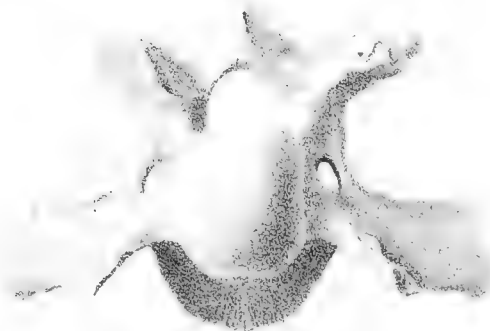
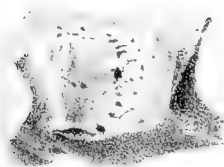
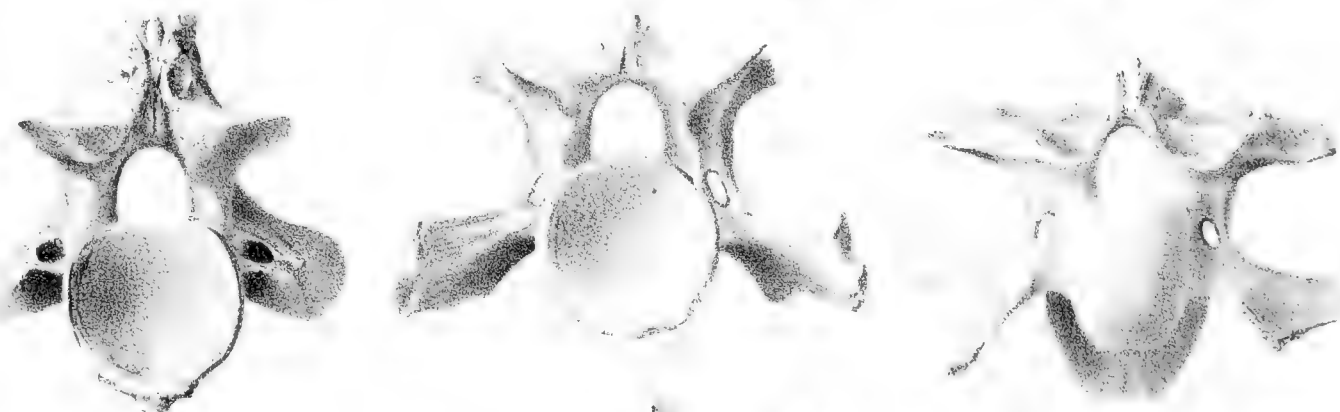
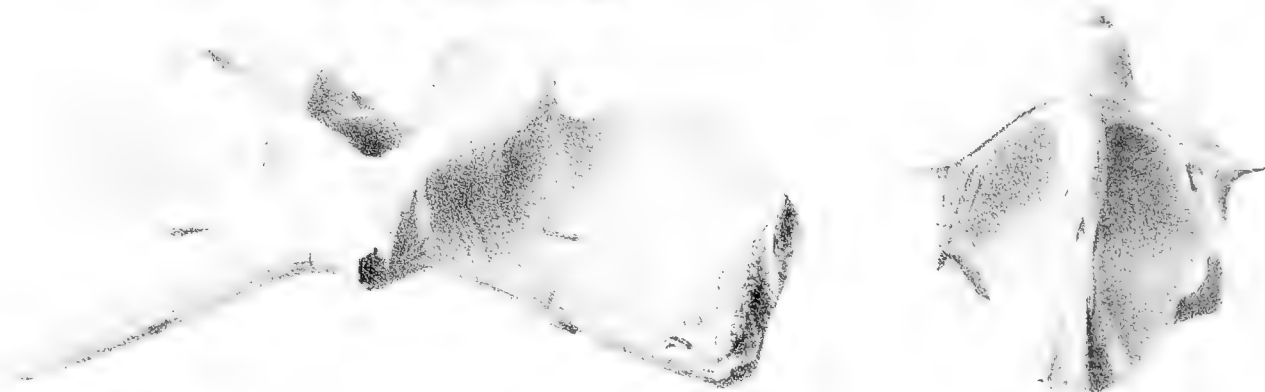
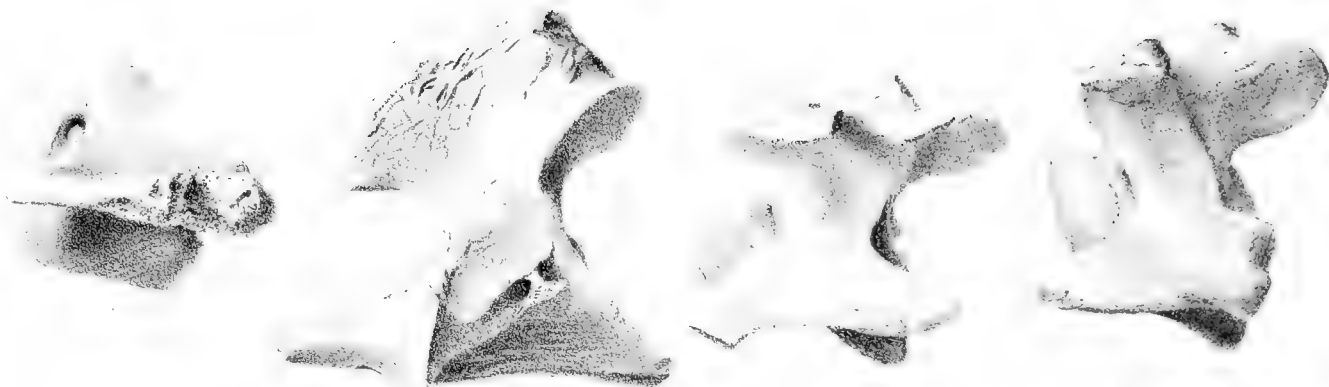


PLATE CXXX.

MIOCENE RHINOCEROSES. LIMB AND FOOT BONES OF APHELOPS

FIGS. 1-15. *Aphelops megalodus* Cope, 1873. Pawnee Creek beds, near Pawnee Buttes, Weld Co., Colorado.

Figs. 1-3. Amer. Mus. No. 8293a, Cope Coll. Fig. 1, 1a, 1b, second metacarpal, anterior, external and internal views; fig. 2, 2a, fourth metacarpal, anterior and external views; fig. 3, 3a, 3b, 3c, radius, anterior, external, proximal and distal views.

Figs. 4-15. Amer. Mus. No. 8293, Cope Coll., paratype. Back of skull figured on pl. CXXXIV.

Fig. 4. Proximal end of second metacarpal; fig. 5, 5a, head of tibia, posterior and proximal views; fig. 6, 6a, 6b, distal end of tibia, anterior, distal and internal views; fig. 7, 7a, hind foot, dorsal and external views; fig. 8, calcaneum, dorsal view; figs. 9, 9a, astragalus, plantar and distal views; fig. 10, cuboid, internal view; fig. 11, navicular, distal view; fig. 12, metatarsals, proximal view; fig. 13, second metatarsal internal view; fig. 14a, 14b, third metatarsal, internal and external views; fig. 15, fourth metatarsal, internal view.

All figures two-fifths natural size.

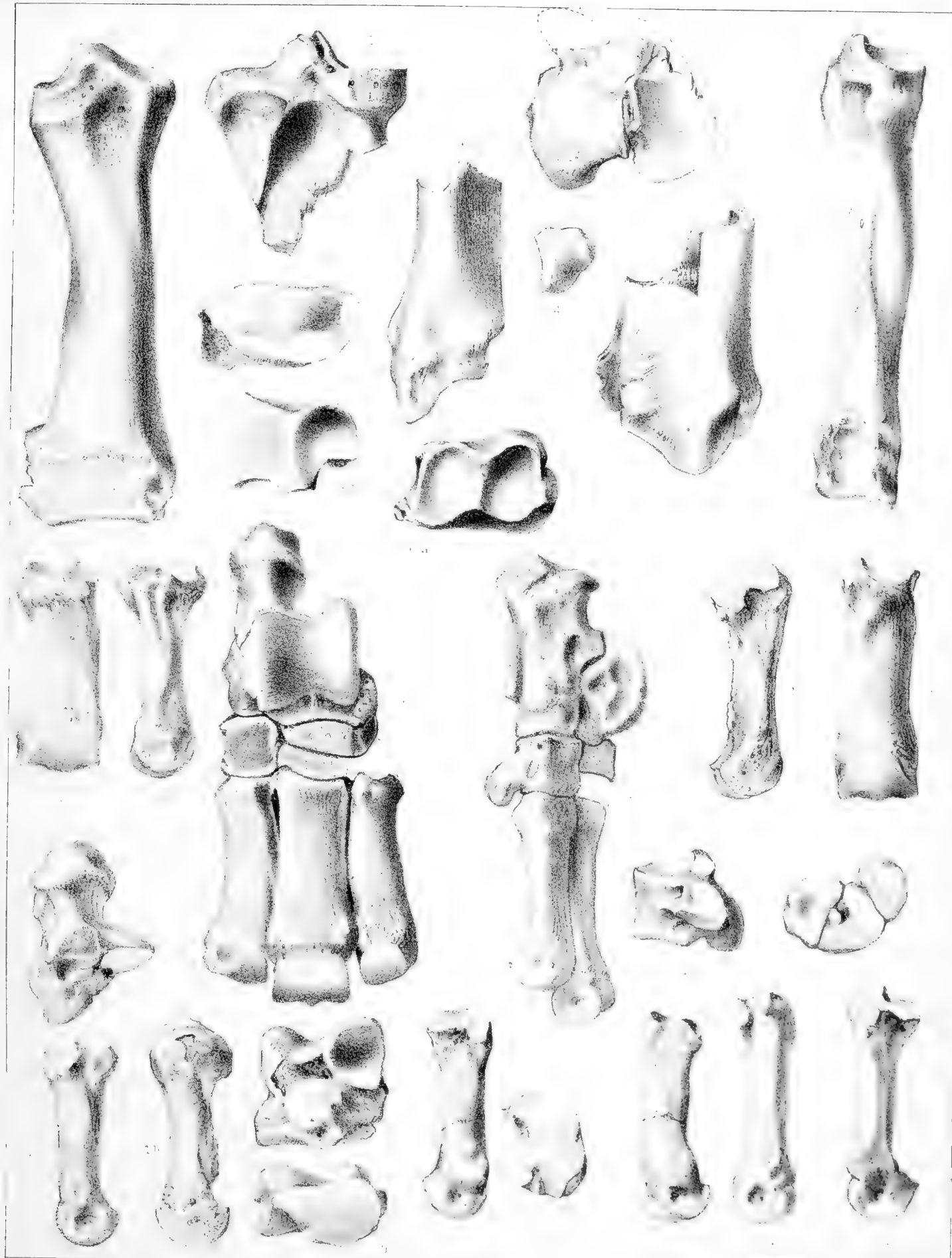


PLATE CXXXI.

MIOCENE RHINOCEROSES. SKULL OF TELEOCERAS

Nomenclature

Cope 1880-3
Aphelops fossiger

Revised 1915
Teleoceras (= Eusyodon) fossiger

Teleoceras fossiger (Cope, 1878). Side view of skull one-half natural size. Amer. Mus. No. 8383, Cope Coll. Republican River beds, Decatur Co., Kansas. Specimen figured on pl. CXXXII and CXXXIV.



PLATE CXXXII.

MIOCENE RHINOCEROSSES. SKULL OF TELEOCERAS

Nomenclature

Cope 1880-3	Revised 1915
Aphelops fossiger	Teleoceras fossiger

Teleoceras (= *Eusgodon*) *fossiger* (Cope, 1878). Top view of skull, two-fifths natural size. Amer.
Mus. No. 8383, Cope Coll. Republican River beds, Decatur Co., Kansas.
Specimen figured on pll. CXXXI and CXXXIV.

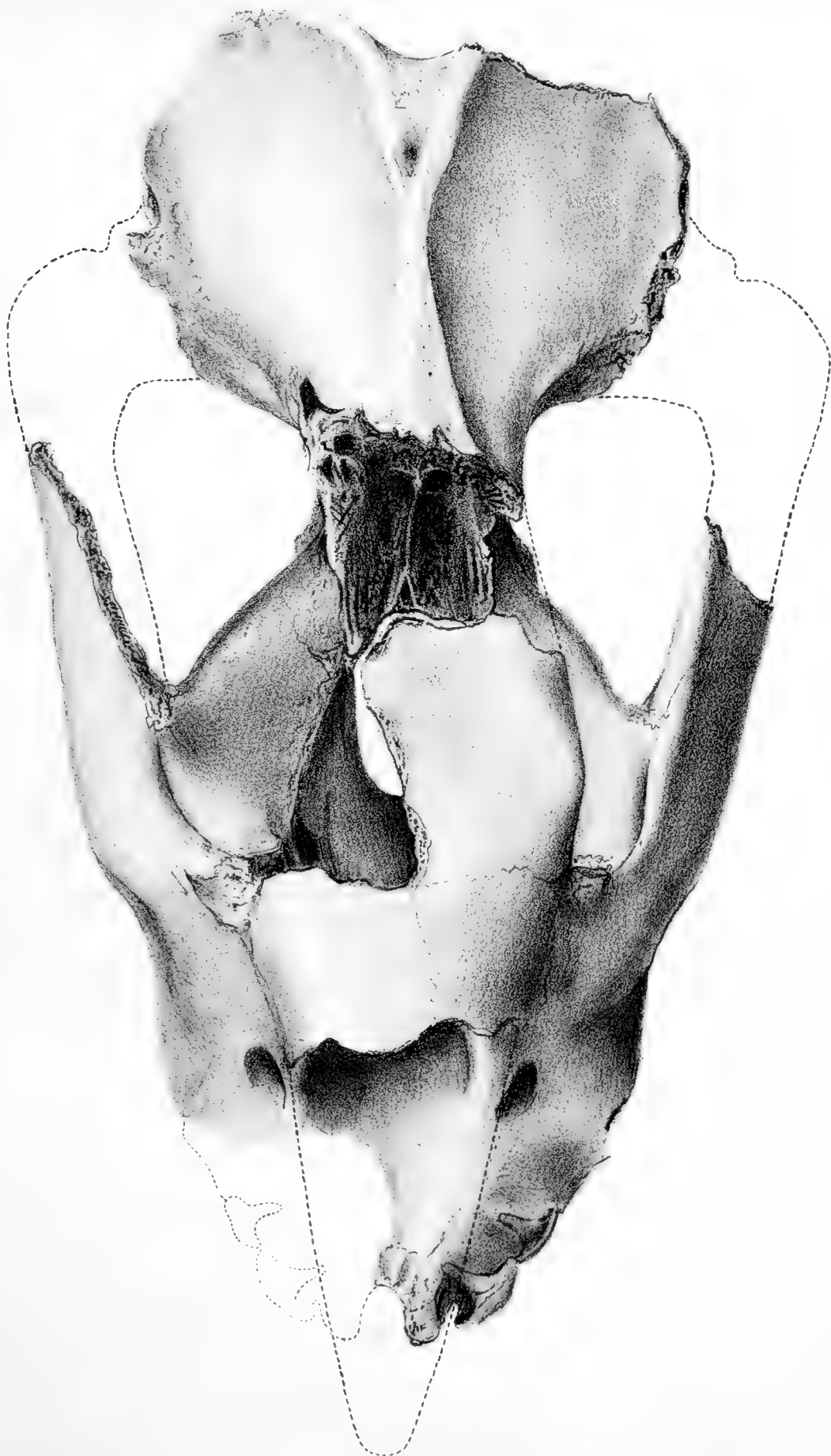


PLATE CXXXIII.

MIocene RHINOCEROSSES. SKULL OF TELEOCERAS

Teleoceras (= *Eusyodon*) *fossiger* Cope, 1878. Palatal view of skull, two-fifths natural size.
Type specimen, Amer. Mus. No. 8390, Cope Coll. Republican River beds,
Decatur Co., Kansas. Specimen figured on pl. CXXXV.

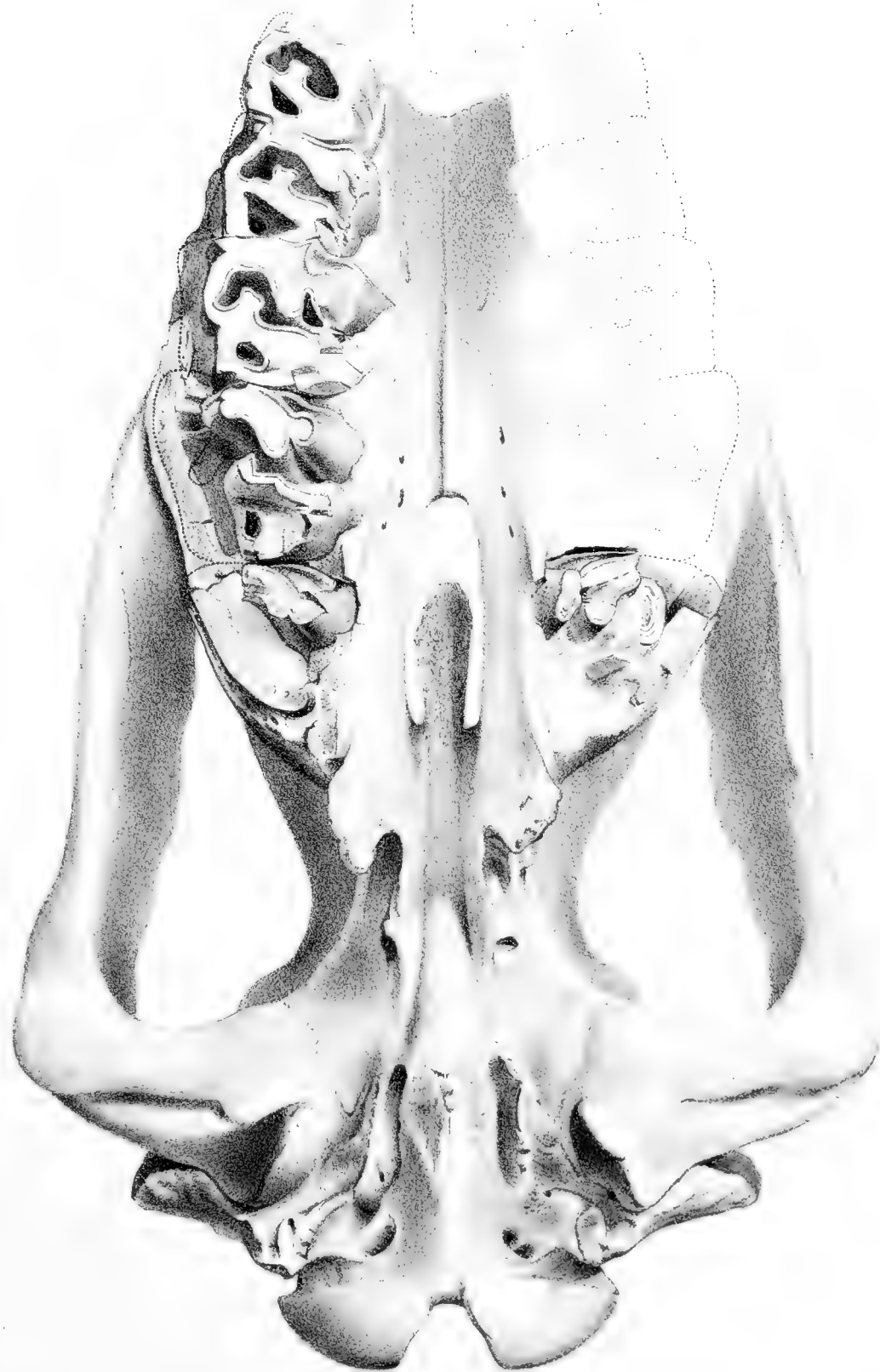


PLATE CXXXIV.

MIocene RHINOCEROSES. SKULLS OF APHELOPS AND TELEOCERAS

- FIG. 1. *Teleoceras* (= *Eusyodon*) *fossiger* (Cope, 1878). Occipital view of skull. Amer. Mus. No. 8383, figured on pl. CXXXI-CXXXII.
- FIG. 2. *Teleoceras* (= *Eusyodon*) *fossiger* (Cope, 1878). Top view of skull. Amer. Mus. Cope Coll. Republican River beds, Decatur Co., Kansas.
- FIG. 3. *Aphelops megalodus* Cope, 1873. Occipital view of incomplete skull. Amer. Mus. No. 8383, Pawnee Creek beds, near Pawnee Buttes, Colorado. Specimen figured on pl. CXXIX and CXXX.
- All figures two-fifths natural size.

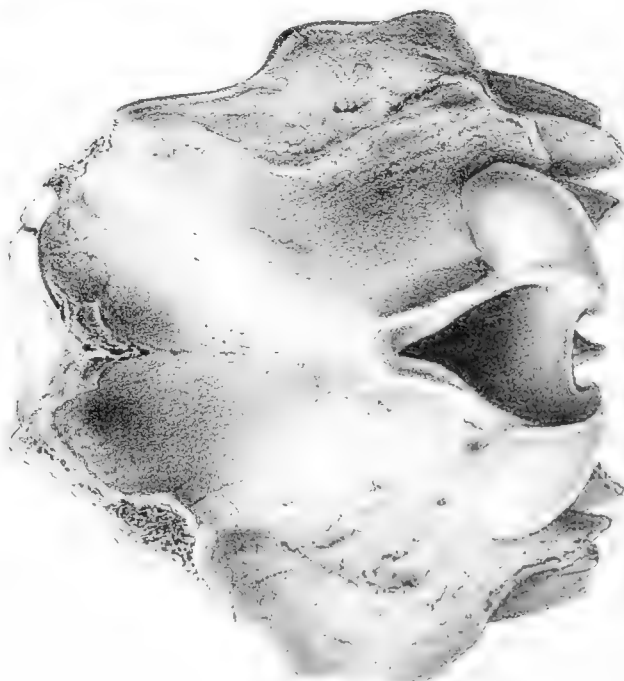
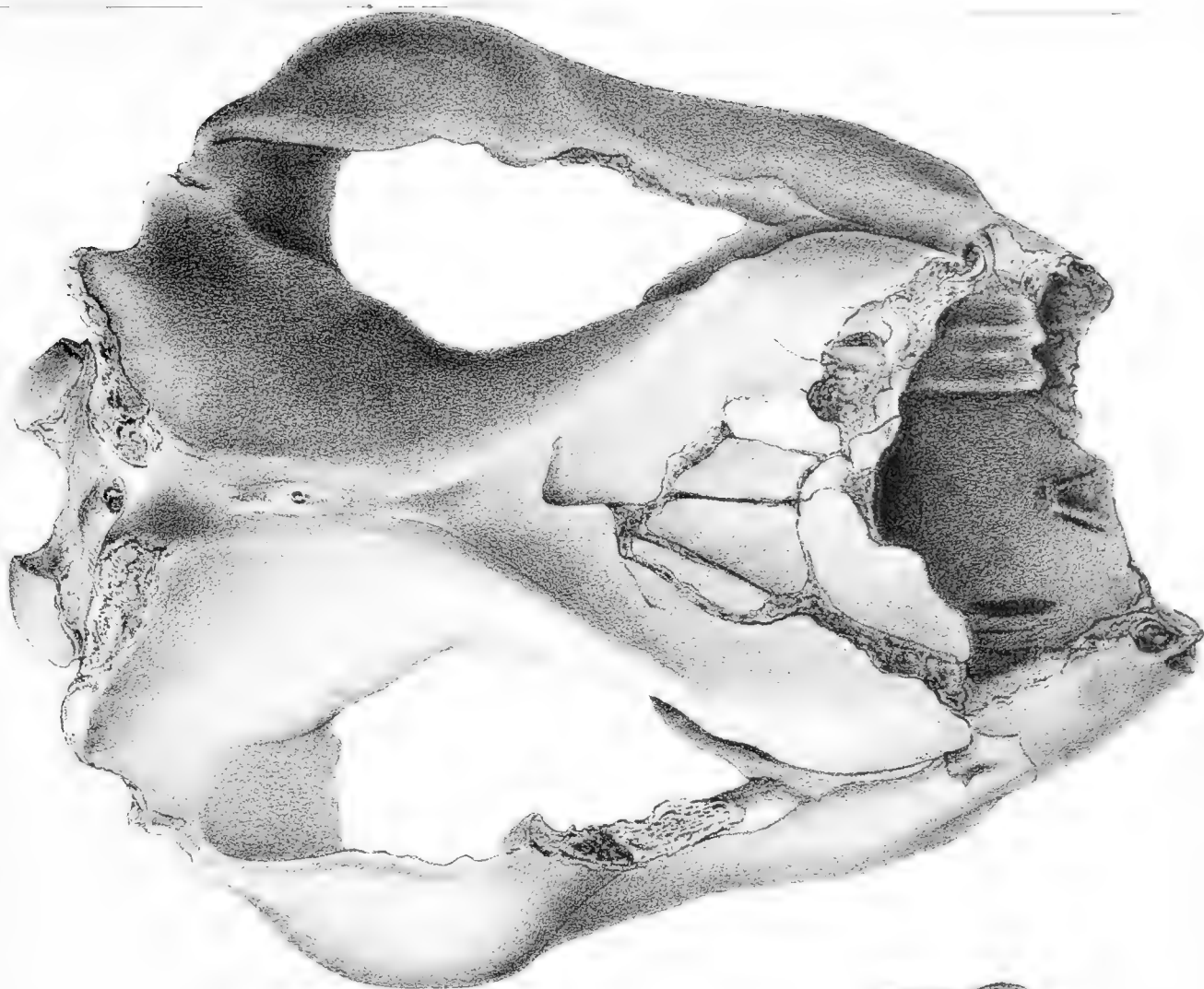


PLATE CXXXV.

MIocene RHINOCEROSSES. SKULLS OF APHELOPS AND TELEOCERAS

- FIG. 1. *Aphelops megalodus* Cope, 1873. Skull and lower jaws, occipital view, one-third natural size. Type specimen, Amer. Mus. No. 8292, Cope Coll., figured on pll. CXXV-CXXX. Pawnee Creek beds, near Pawnee Buttes, Colorado.
- FIG. 2. *Teleoceras* (= *Eusyodon*) *fossiger* (Cope, 1878). Skull, occipital view, one-third natural size. Type specimen, Amer. Mus. No. 8390, Cope Coll., figured on pll. CXXXIII.



PLATE CXXXVI.

MIocene RHINOCEROSSES. VERTEBRÆ OF TELEOCERAS

Nomenclature

FIGS. 1-6. *Teleoceras* (= *Eusyodon*) *fossiger* (Cope, 1878). Cervical and dorsal vertebræ, two-fifths natural size. Amer. Mus. Cope Coll. Republican River beds, Decatur Co., Kansas.

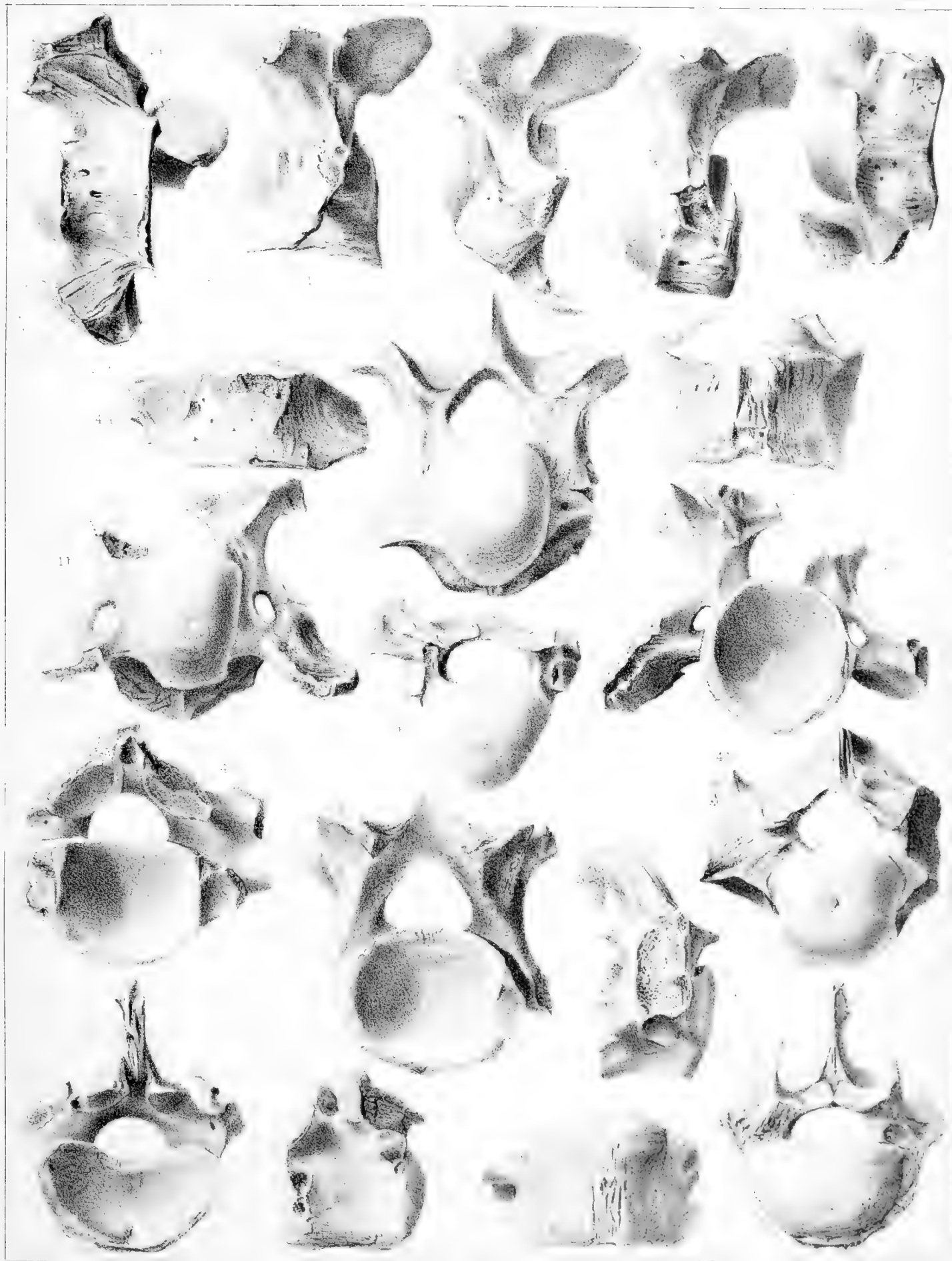


PLATE CXXXVII.

MIocene RHINOCEROSES. LIMB AND FOOT BONES OF TELEOCERAS

Nomenclature

Cope 1880-3	Revised 1915
Aphelops (in part)	Teleoceras

FIGS. 1-7. Pelvis and foot bones chiefly of *Teleoceras fossiger*. Amer. Mus. Cope Coll. Republican River beds, Decatur Co., Kansas.

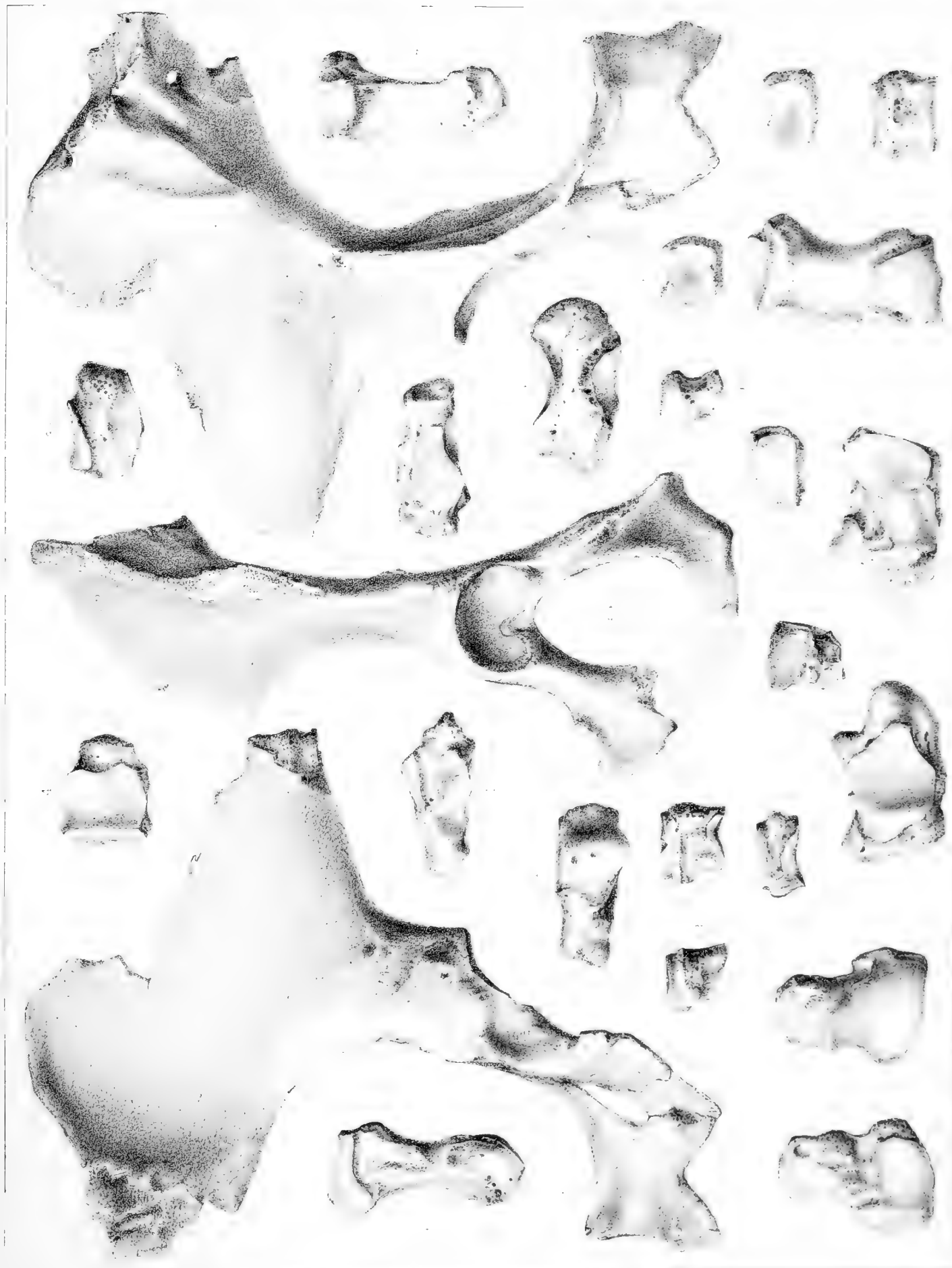


PLATE CXXXVIII.

MIocene RHINOCEROSES. LIMB AND FOOT BONES OF TELEOCERAS

FIGS. 1-9. Limb and foot-bones chiefly of *Teleoceras fossiger*. Amer. Mus. Cope Coll. Republican River beds, Decatur Co., Kansas.

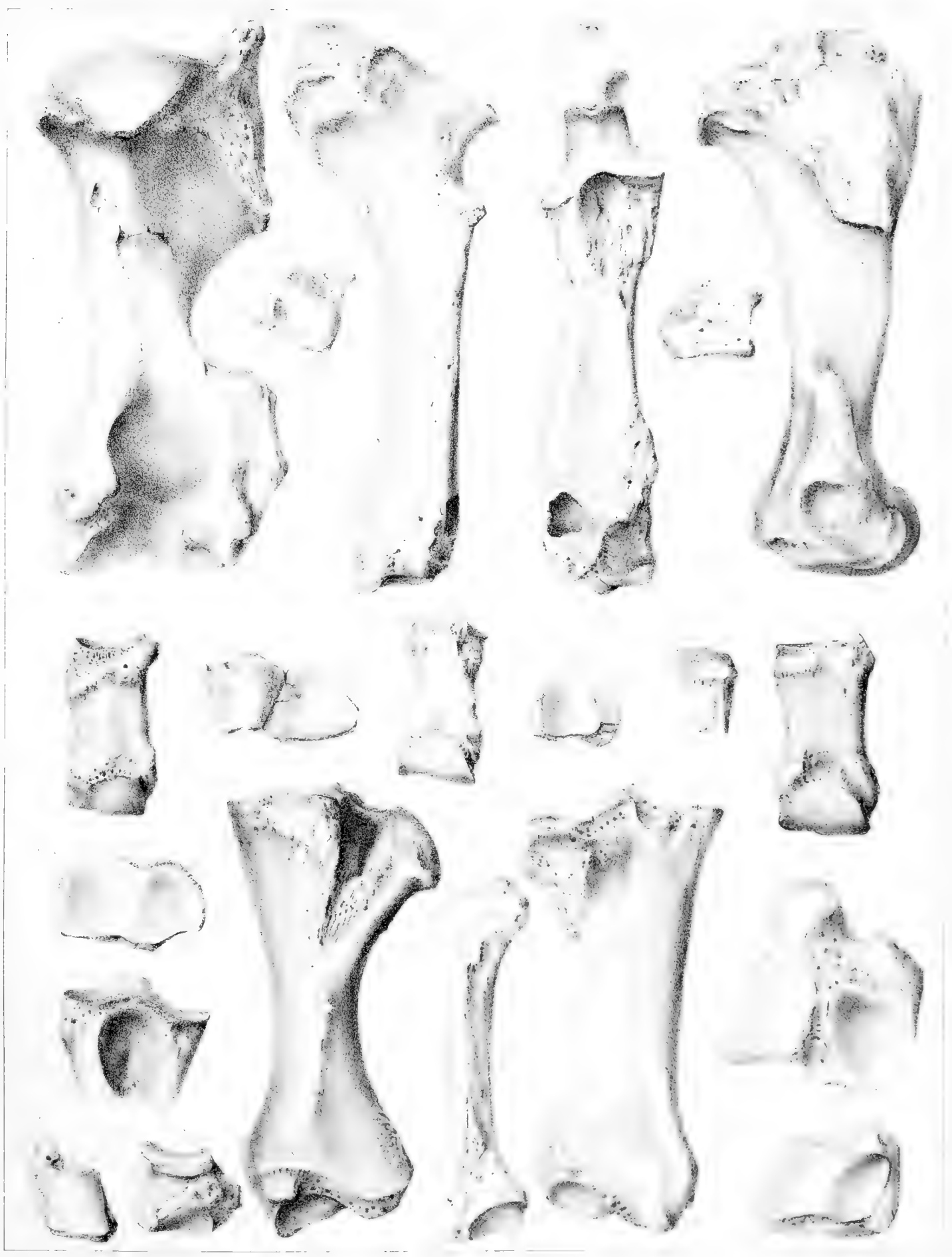


PLATE CXXXIX.

MIocene RHINOCEROSES. SKULL OF APHELOPS MALACORHINUS

Aphelops malacorhinus Cope, 1879. Side view of skull one-half natural size. Type specimen, Amer. Mus. No. 8381, Cope Coll. Republican River beds, Hitchcock Co., Nebraska. Specimen figured on pll. CXL-CXLI.



PLATE CXL.

MIocene RHINOCEROSES. SKULL OF APHELOPS MALACORHINUS

Aphelops malacorhinus Cope, 1878. Superior view of skull, two-fifths natural size. Type specimen, Amer. Mus. No. 8381, Cope Coll. Republican River beds, Nebraska. Specimen figured on pl. CXLI.



APHELOPS MALACORHINUS •

PLATE CXLI.

MIocene RHINOCEROSES. SKULL OF APHELOPS MALACORHINUS

Aphelops malacorhinus Cope, 1878. Palatal view of skull, two-fifths natural size. Type specimen, Amer. Mus. No. 8381, Cope Coll., from Republican River beds of Nebraska. Specimen figured on pl. CXL.

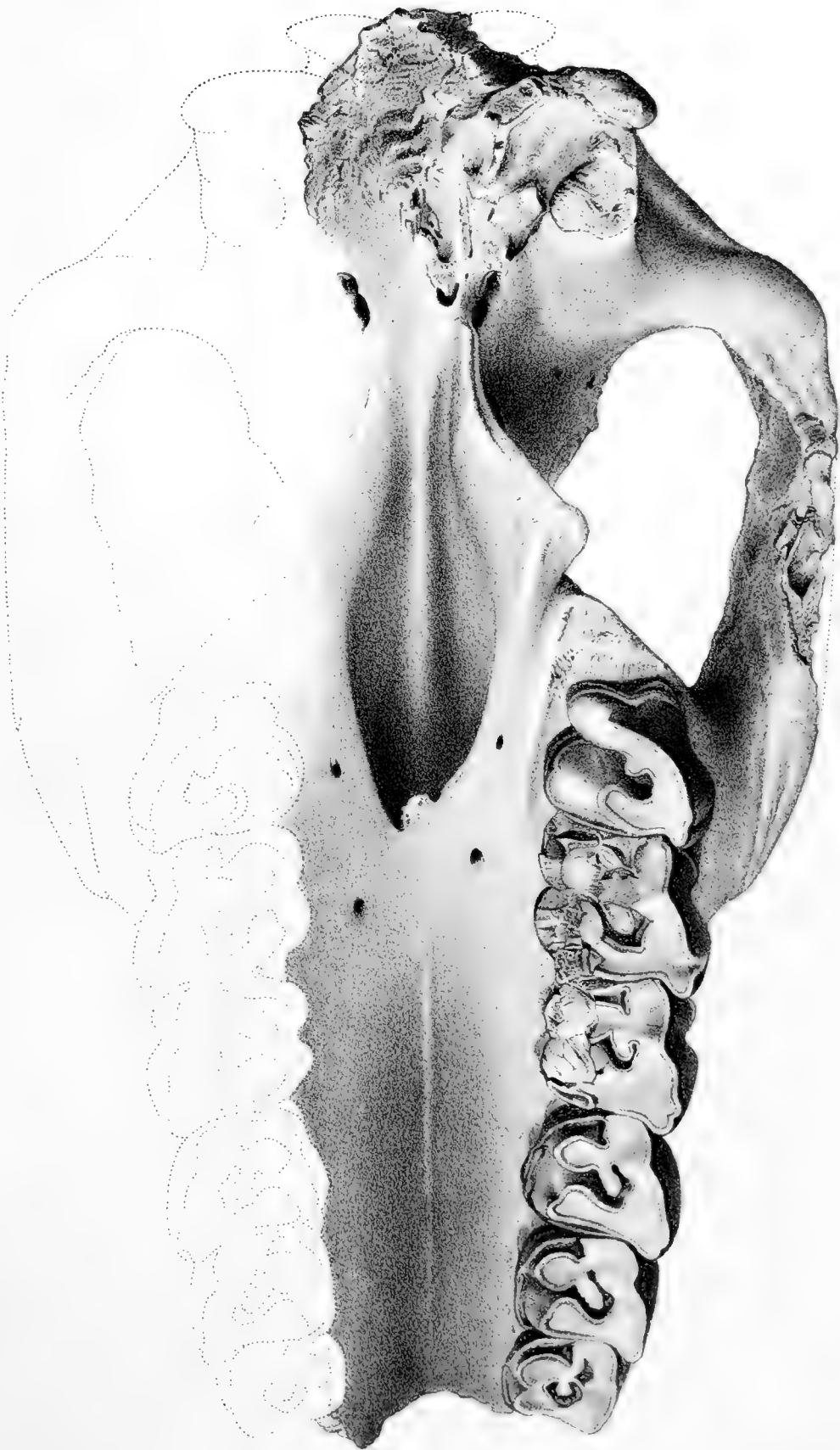


PLATE CXLII.

MIocene RHINOCEROSSES. BONES OF APHELOPS MALACORHINUS

FIGS. 1-6. *Aphelops malacorhinus* Cope, 1878. Skeleton bones referred to this species by Professor Cope. Amer. Mus. Cope Coll., from Republican River beds, Nebraska.

Fig. 1, 1a, 1b, pelvis, anterior, posterior and external views, one-fourth natural size; fig. 2, 2a, tibia, anterior and distal views, two-fifths nature; figs. 3-6, dorsal and a cervical vertebra, two-fifths nature.

These specimens were presumably referred to this species on account of their being found associated with the type or some referred skull material of *A. malacorhinus*; but the record of such association has been lost, and a search through the published references, field records and other possible sources of information has failed to recover any conclusive evidence upon it. The association of skull and skeletal parts in the related species *A. ceratorhinus* Douglass indicates however that these bones are correctly referred to *A. malacorhinus*. (W. D. M.).

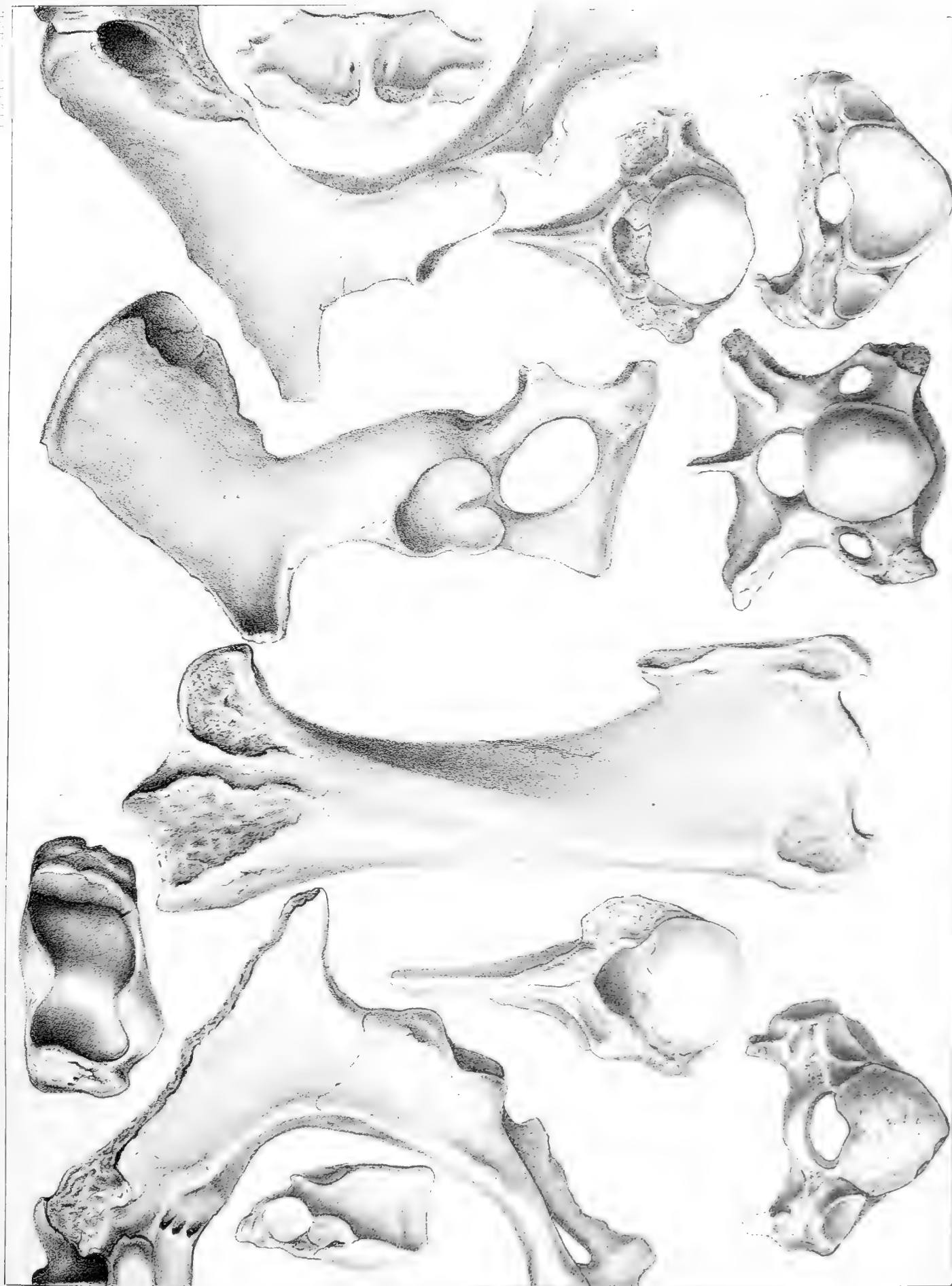




PLATE CXLIII.

MIocene RHINOCEROSES

SKULL AND SKELETAL PARTS OF APHELOPS ? MALACORHINUS

- FIGS. 1-7. Remains of Rhinoceroses, part or all referable to *Aphelops malacorhinus*. Amer. Mus. Cope Coll. Republican River Bed, Kansas or Nebraska.
- Fig. 1. Humerus, anterior view.
- Fig. 2. Part of maxilla.
- Fig. 3. *Aphelops malacorhinus*, occipital view of skull. Paratype, Amer. Mus. No. 8439, Cope Coll.
- Fig. 4, 4a. Cervical vertebra, lateral and inferior views.
- Fig. 5, 5a, 5b. Ulna, probably *A. malacorhinus*, external, anterior and distal views. No. 8382.
- Fig. 6, 6a. Proximal and distal ends of femur.
- Fig. 7, 7a, 7b. Astragalus, dorsal, plantar and distal views.

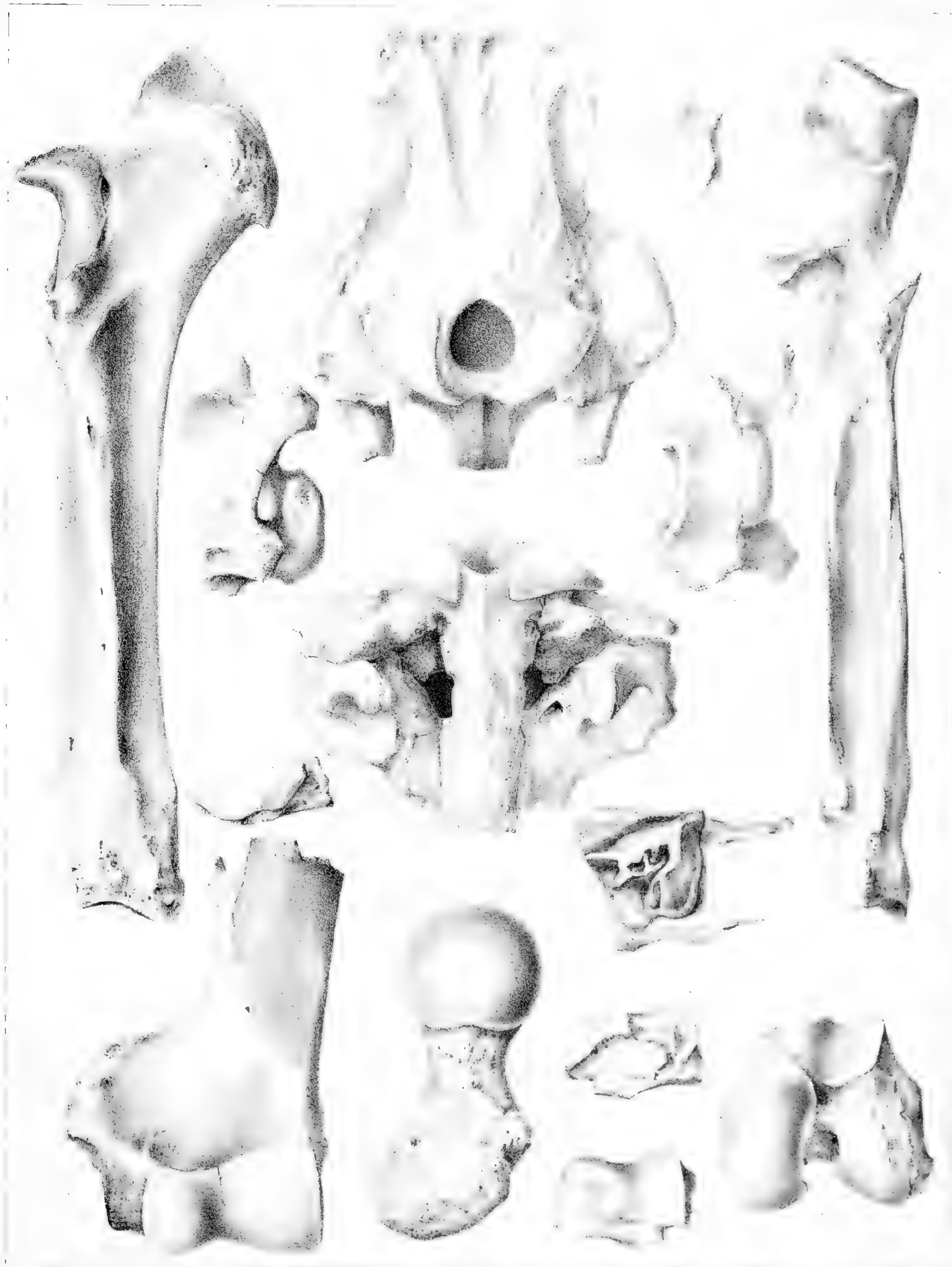


PLATE CXLIV.

MIOCENE RHINOCEROSSES. SKULL OF PERACERAS

Peraceras superciliosus Cope, 1880. Side view of skull, one-half natural size. Type specimen,
Amer. Mus. No. 8380. Republican River beds, Nebraska.
Specimen figured on pl. CXLIVb.



PLATE CXLIVb.

MIocene RHINOCEROSES. SKULL OF PERACERAS

Peraceras superciliosus Cope, 1880. Top view of skull, two-fifths natural size. Type specimen,
No. 8380, figured on pl. CXLIV.

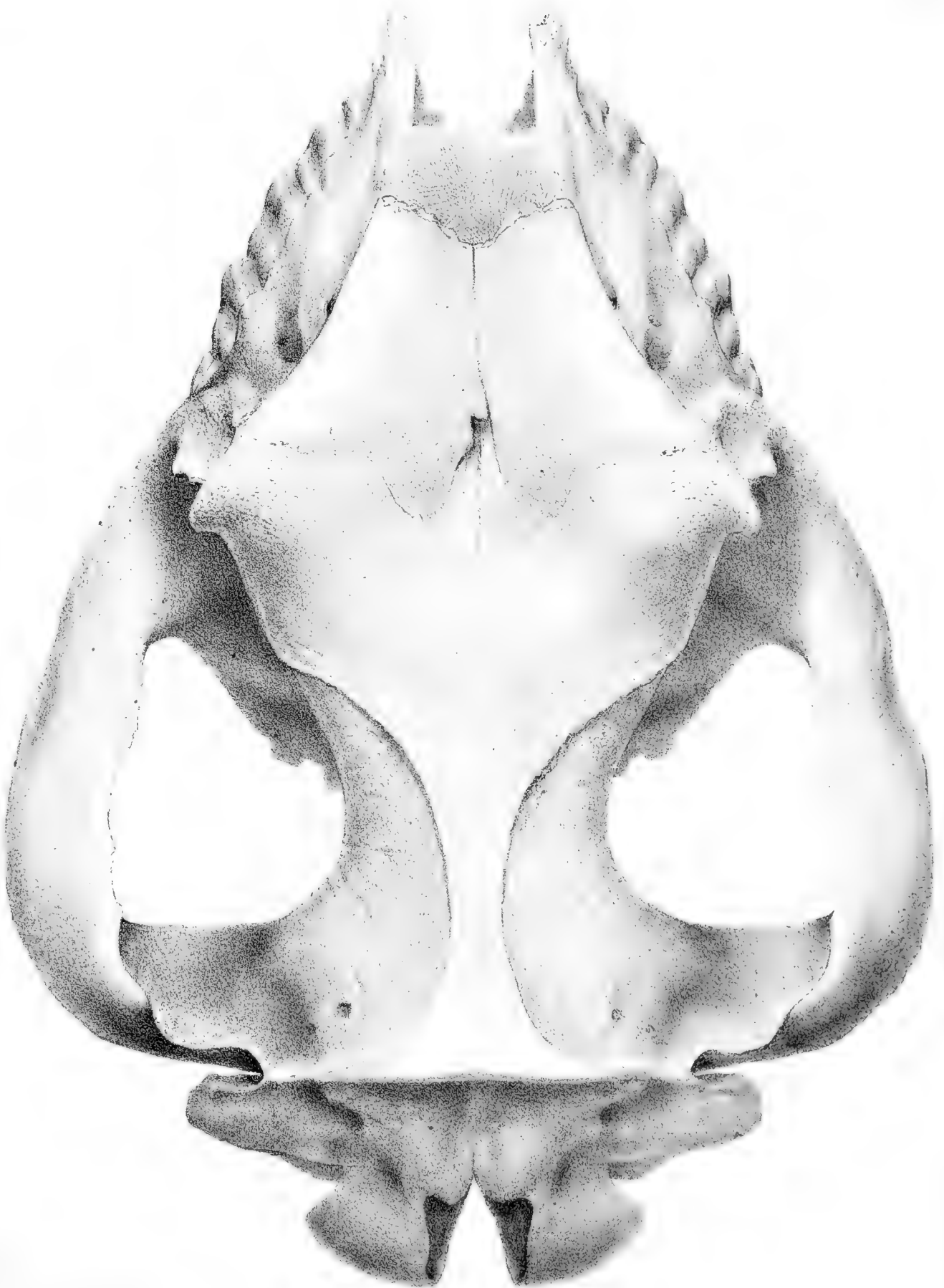


PLATE CXLV.

MIocene EQUIDÆ. SKULL OF MERYCHIPPUS

Nomenclature

Cope 1880-3	Revised 1915
<i>Hippotherium speciosum</i> (in part)	<i>Merychippus</i> sp.

- FIGS. 1-3. *Merychippus* sp. Skull, lateral, palatal and superior views, one-half natural size.
Amer. Mus. No. 8347, Cope Coll., from Republican River beds, Driftwood Creek,
Hitchcock Co., Nebraska.
- FIG. 4. *Merychippus* sp. Fourth premolar and first molar of No. 8347, natural size, crown view.

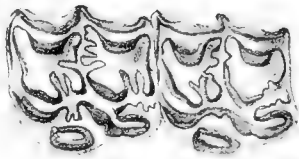
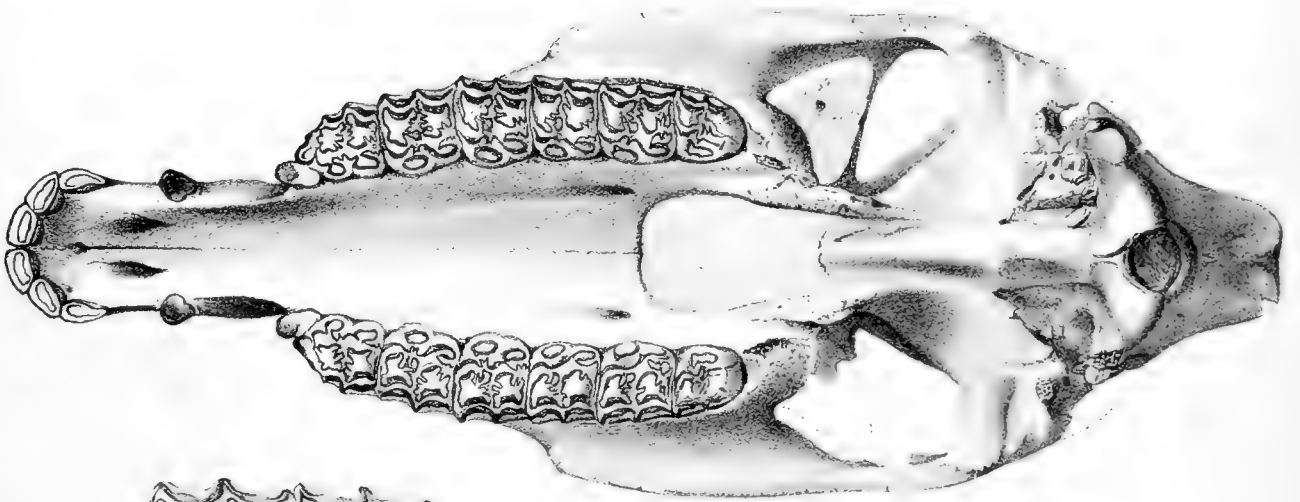


PLATE CXLVII.

MIocene EQUIDÆ. SKULL AND BONES OF MERYCHIPPUS

Nomenclature

Cope 1880-3	Revised 1915
Hippotherium seversum (in part)	Merychippus isonesus

FIGS. 1-8. *Merychippus isonesus* (Cope, 1889). Skull and parts of skeleton, figured also on pl. CXLVIII. All one-half natural size except fig. 16. Type specimen, Amer. Mus. No. 8175, Cope Coll. Mascall formation, Cottonwood Creek, John Day Valley, Oregon.

Fig. 1, 1a, skull, lateral and palatal views; fig. 1b, two upper molars, m^{1-2} of the right side, natural size; fig. 2, 2a, atlas, superior and posterior views; fig. 3, sacrum, inferior view; fig. 4, pelvis, inferior view; figs. 5, 6, proximal and distal views of femur; figs. 7, 8, proximal and distal views of tibia; fig. 9, inferior view of astragalus.

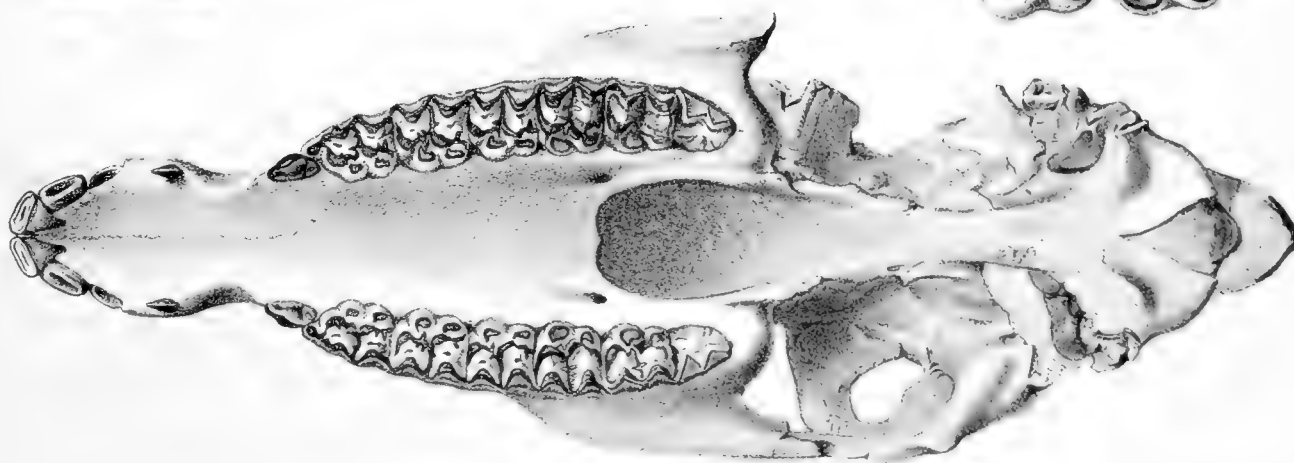
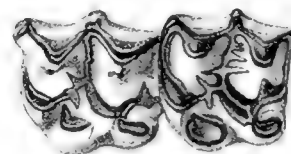
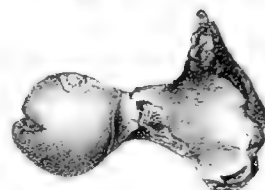
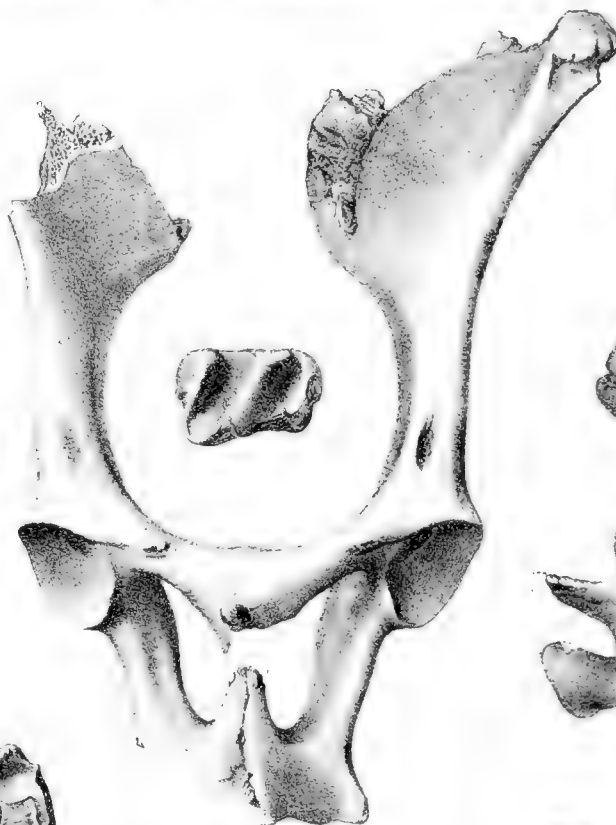
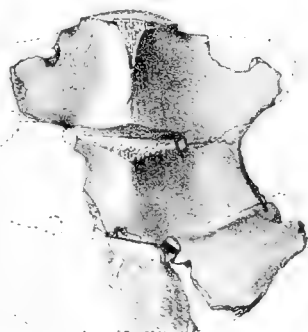
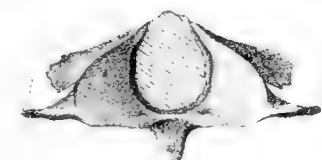


PLATE CXLVIII.

MIOCENE EQUIDÆ. SKELETON OF MERYCHIPPUS

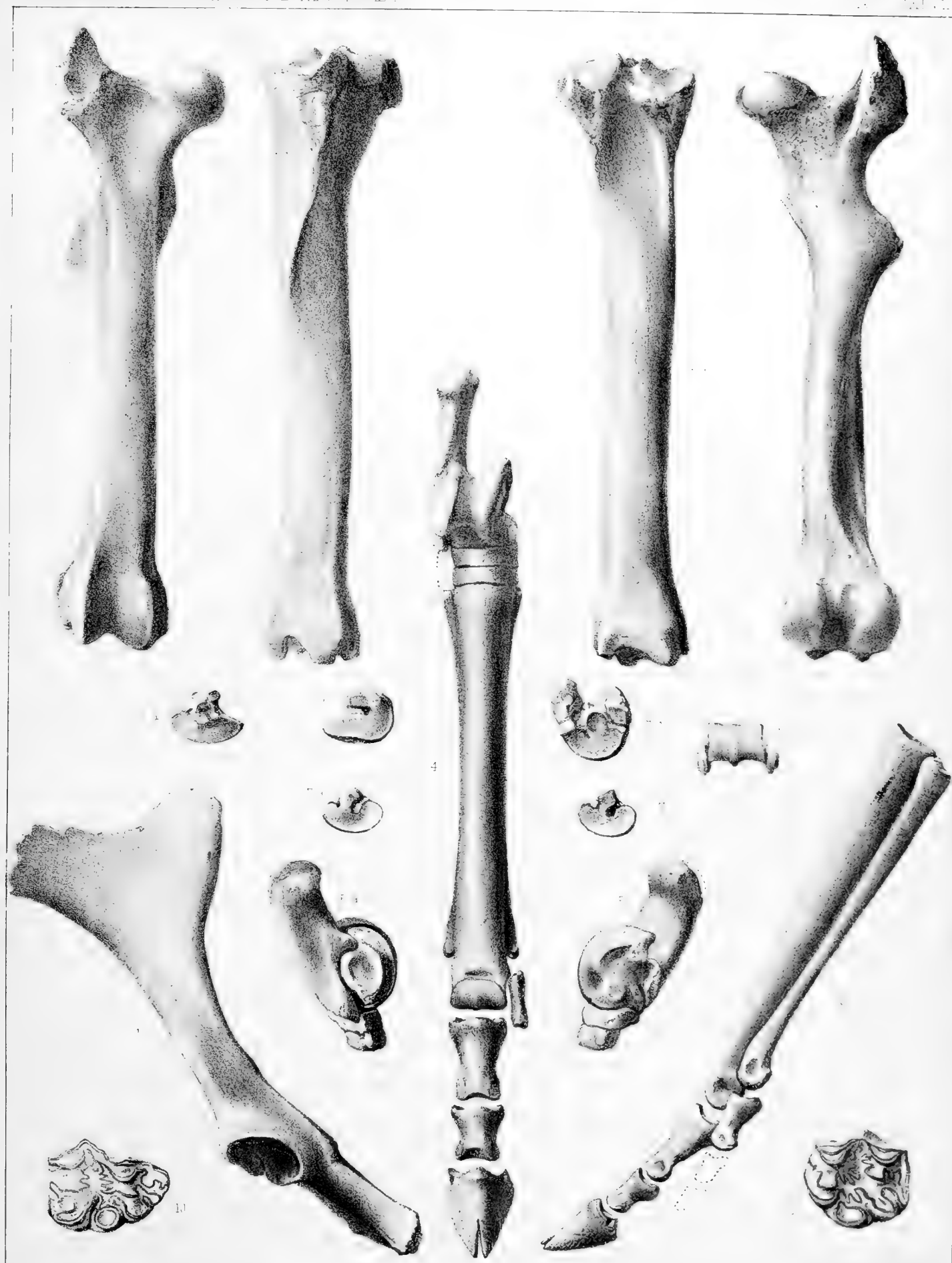
Nomenclature

Cope 1880-3	Revised 1915
Hippotherium seversum (in part)	Merychippus isonesus
Hippotherium sphenodus	Merychippus sphenodus

FIGS. 1-8. *Merychippus isonesus* Cope, 1889. Parts of skeleton with skull figured on pl. CXLVII. One-half natural size. Type specimen, Amer. Mus. No. 8175, Cope Coll. Mascall formation, Cottonwood Creek, John Day Valley, Oregon.

Fig. 1. Pelvis, external view; fig. 2, 2a, femur, anterior and posterior views; fig. 3, 3a, tibia, anterior and posterior views; fig. 4, hind foot, dorsal view; fig. 5, 5a, internal and external views; figs. 6, 6a, navicular, proximal and distal views; fig. 7, 7a, ectocuneiform, proximal and distal views; fig. 8, metatarsals and phalanges, internal view; 8a, 8b, proximal and distal views of metatarsus.

FIGS. 9-10. *Merychippus sphenodus* Cope, 1889. Upper premolars, crown view, natural size. Type specimen, Amer. Mus. No. 8281, Cope Coll., Pawnee Creek beds, Pawnee Buttes, Colorado.



1-5 HIPFOTHERIUM SEVERNUM. 6-12. - " - "

PLATE CXLVIIIa.

MIOCENE EQUIDÆ. TEETH AND BRAIN CAST OF MERYCHIPPUS, ETC.

Nomenclature

Cope 1880-3	Revised 1915
Hippotherium sphenodus	Merychippus sphenodus
Protohippus (in part)	Protohippus sp., aff. perditus
Protohippus perditus (in part)	Merychippus sejunctus
Protohippus insignis (Cope, non Leidy)	Merychippus labrosus etc.
Protohippus sejunctus (in part)	Merychippus isonesus
Hippidium spectans	Pliohippus spectans

- FIG. 1. *Merychippus* ? *sphenodus* (Cope, 1889). Upper premolars; paratype, natural size, Amer. Mus. No. 8281a, Cope Coll., Pawnee Creek beds, Colorado.
- FIG. 2. ? *Merychippus*, unidentified specimen, upper molars.
- FIG. 3. *Merychippus sejunctus*. Upper teeth, natural size, crown view. Amer. Mus. No. 8254, Cope Coll., recorded as "East of Laramie Peak, Wyoming."
- FIG. 4. *Protohippus* sp., aff. *perditus*. Upper teeth, crown view, natural size. Am. Mus. No. 8340, Cope Coll., Republican River Bed, Nebraska. Hind foot of this individual figured on pl. CXLIX.
- FIGS. 5-7. Type specimens of *Protohippus labrosus* Cope, Amer. Mus. No. 8266, Pawnee Creek Bed, Pawnee Buttes, Colorado. Fig. 5, upper teeth, crown view, natural size; fig. 6, 6a, lower jaw external and superior views, half natural size; fig. 7, upper jaw, half natural size, external view. Part of this specimen is now missing, only the lower jaw (fig. 6) being identifiable. This lower jaw is a composite of two individuals, the symphysis belonging certainly to a different individual and probably to a distinct species from the remainder of the jaw, which along with the upper teeth figured here (fig. 5) but now lost, agrees very nearly with *Merychippus sejunctus*. The symphysis, however, which in conformity with the author's description and evident intent must be regarded as the primary basis of the species and selected as *lectotype*, is clearly distinct from *M. sejunctus* and cannot be correlated with any of the better known species. W. D. M., 1913.
- FIG. 8, 8a. *Merychippus isonesus*, natural braincast, lateral and superior views. From the specimen figured on pl. CXLIX. Amer. Mus. No. 8105, Cope Coll., Deep River beds, Deep River (Smith Creek), Montana.
- FIGS. 9-11. *Pliohippus spectans* (Cope, 1880). Upper teeth, natural size, type specimen, Amer. Mus. No. 8183, Cope Coll., Mascall formation, Cottonwood Creek, John Day Basin, Oregon. Fig. 9, 9a, first or second, upper molar, crown and anterior views; fig. 10, second upper premolar crown view; fig. 11, upper incisor, crown view.

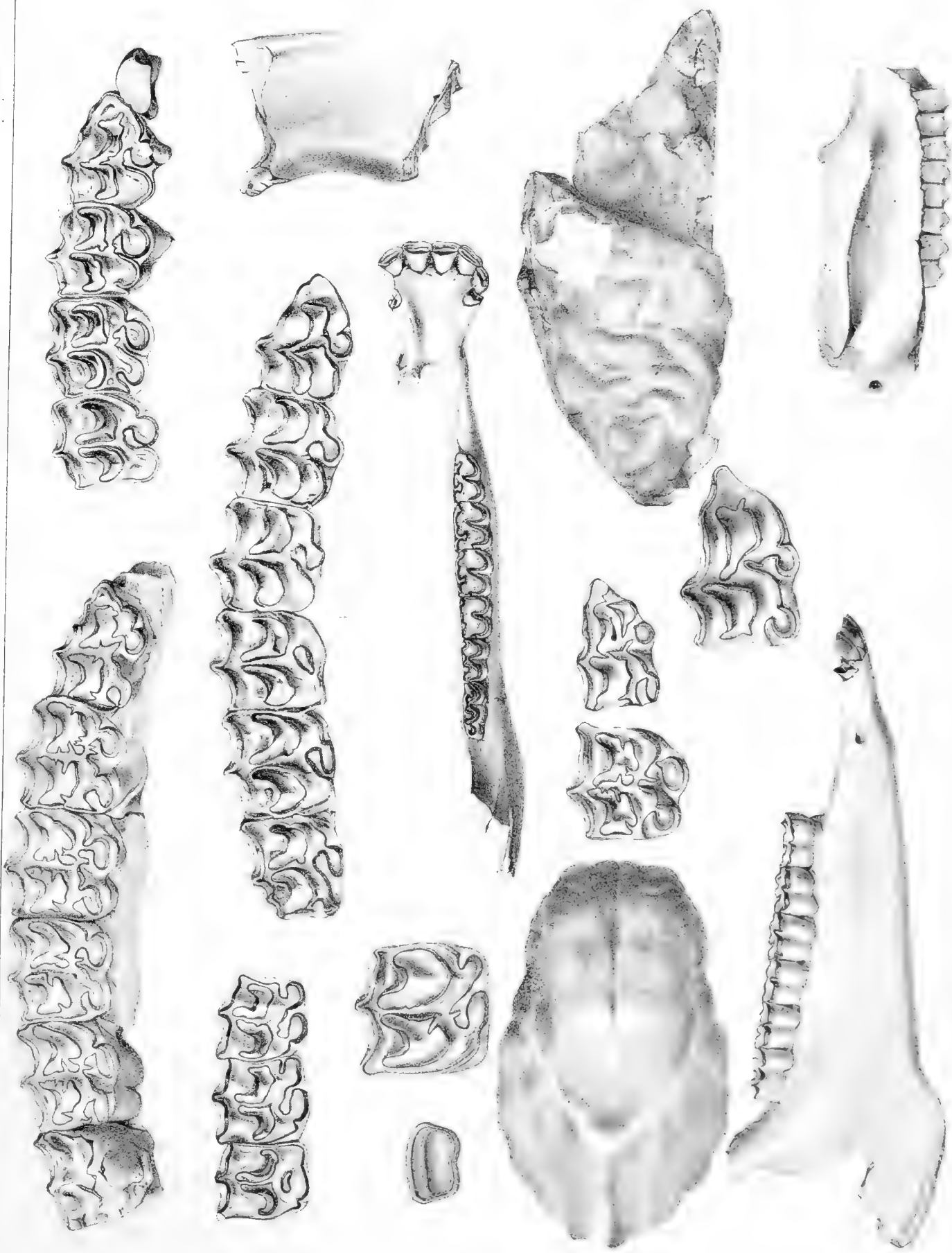


PLATE CXLIX.

LIMB AND FOOT BONES OF MIOCENE EQUIDÆ

Nomenclature

Cope 1880-3	Revised 1915
Protohippus sejunctus (in part)	Merychippus isonesus
Protohippus perditus	Protohippus sp. aff. perditus
Hippidium ? pernix	? Hipparion sp.

- FIGS. 1-4. *Merychippus* ? *isonesus* (Cope, 1889). Limb and foot bones with skull. Amer. Mus. No. 8105, Cope Coll., Deep River beds, Deep River (Smith Creek), Montana. Fig. 1, 1a, ulno-radius, anterior and external views, one-half natural size; fig. 2, 2a, 2b, 2c, fore foot, anterior and external views, with proximal and distal views of metatarsus half natural size; fig. 3, proximal view of magnum and unciform with part of metacarpal III, two-thirds natural size; fig. 4, proximal view of tibia, one-half nature. See also pl. CXLVIIIa.
- FIG. 5-6. *Protohippus* sp. aff. *perditus*. Parts of skeleton associated with upper jaw figured on pl. CXLVIIIa, Am. Mus. No. 8340, Cope Coll., from Republican River beds, of Nebraska. Fig. 5, pelvis, inferior view; fig. 6, 6a, 6b, anterior, internal, proximal views of median metatarsal; both one-half natural size.
- FIG. 7. Atlas, unidentified (not Equid).
- FIG. 8. ? *Hipparion* sp. Metatarsal III and proximal phalanx, anterior and external views and proximal view of metatarsal, one-half natural size. Amer. Mus. No. 8357, Cope Coll. Republican R. beds, Nebraska. (The specimen includes remains of more than one individual and no teeth are associated, so that the reference is wholly doubtful. It has the proportions of the American species of *Hipparion* but is exceptional among them in the tarso-metatarsal articulation).

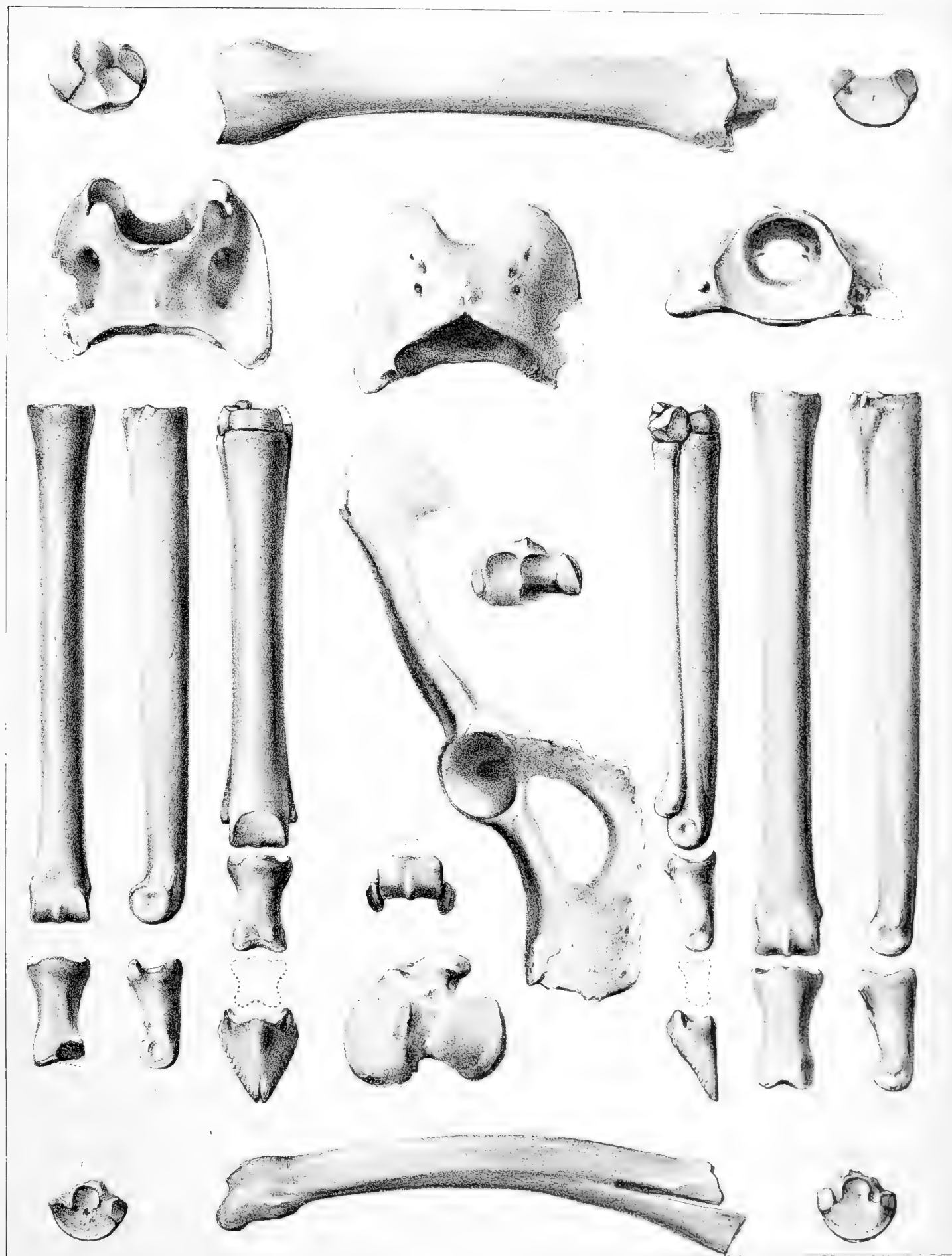


PLATE CL.

MIOCENE EQUIDÆ. SKULL OF MERYCHIPPUS

Nomenclature

Cope 1880-3	Revised 1915
<i>Protohippus sejunctus</i>	<i>Merychippus sejunctus</i>

FIGS. 1-3. *Merychippus sejunctus* (Cope, 1874). Skull of type specimen, lateral, palatal and superior views, one-half natural size. Amer. Mus. No. 8291, Cope Coll., Pawnee Creek beds, near Pawnee Buttes, Weld Co., Colorado.
Skeleton parts figured on pl. CLI.

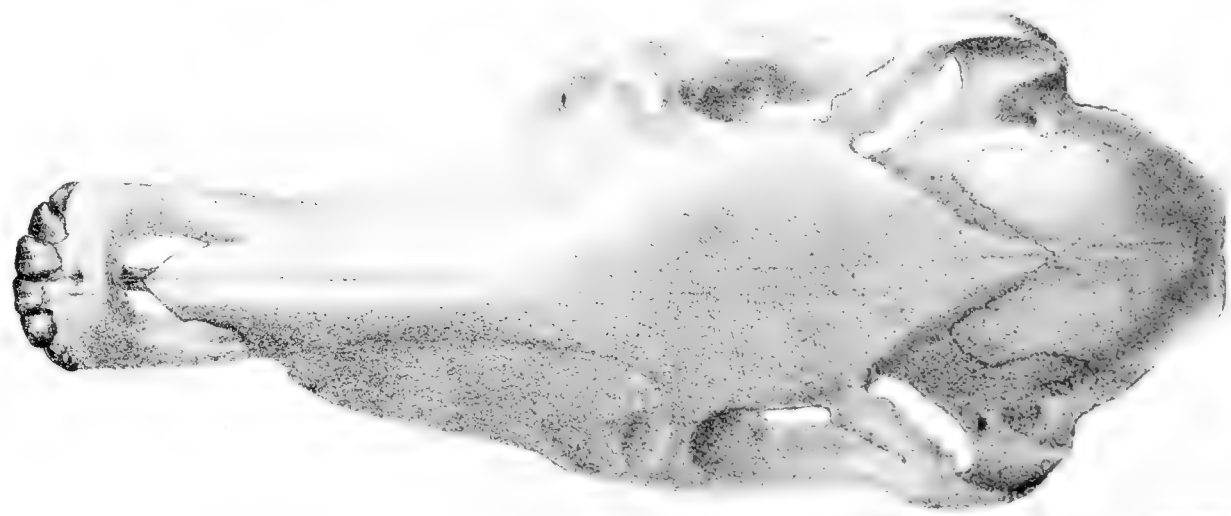
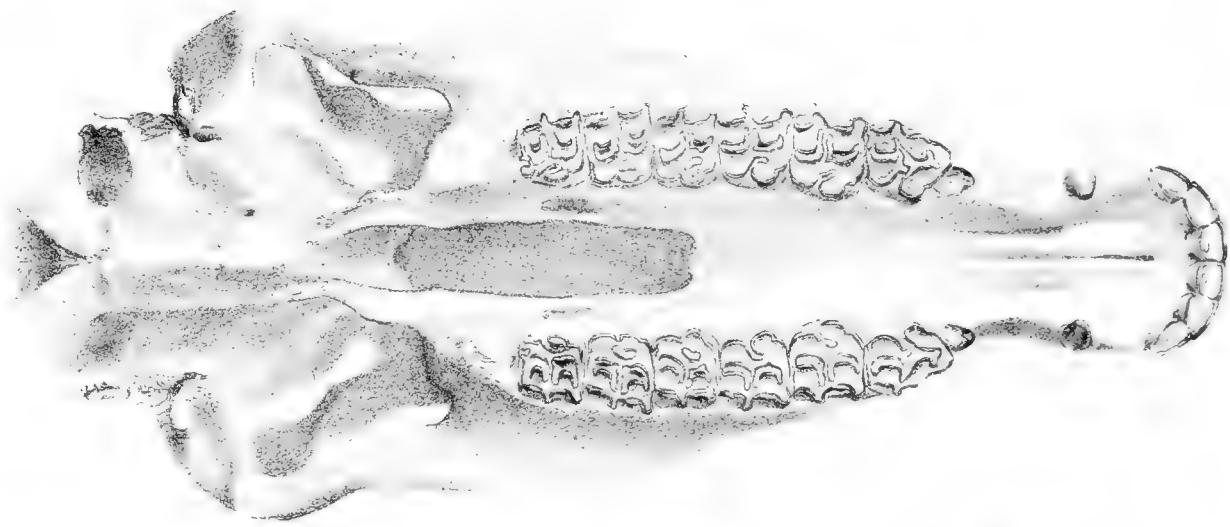


PLATE CLI.

MIocene EQUIDÆ. SKELETON PARTS OF MERYCHIPPUS

FIGS. 1-14. *Merychippus sejunctus* Cope, 1874. Skeletal parts of type specimen, skull figured on pl. CL. All one-half natural size, Amer. Mus. No. 8291, Pawnee Creek beds, near Pawnee Buttes, Colorado.

Fig. 1, lower jaw, superior view; fig. 2, 2a, atlas, superior and inferior views; fig. odontoid 2b, process of axis; fig. 3, 3a, third cervical vertebra, inferior and posterior views; fig. 4, 4a, seventh cervical, anterior and inferior views; fig. 5, 5a, first dorsal, anterior and lateral views; 6, 6a, 6b, 6c, humerus, anterior, external, proximal and distal views; 7, 7a, 7b, tibia, anterior, external and distal views; figs. 8-14, hind foot, anterior and external views, 8b, inferior view of astragalus, 8c, 9b, of calcaneum and astragalus, 10b, proximal view of navicular and cuboid, 11b, 11c, proximal and distal views of metatarsus, 12b, proximal view of proximal phalanx; 13b, of second phalanx, 14b, 14c, proximal and inferior views of ungual phalanx.

The humerus and tibia here figured were found in the Cope Collection with No. 8251, a specimen which Cope referred to *Protohippus perditus*, and which is now (1913) referred to *Merychippus ? sphenodus*. It appears probable that parts of the type skeleton of No. 8291 had become mixed with No. 8251, but the two individuals are so closely allied specifically that I am unable to clear up the confusion.



PROTOHII 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

PLATE CLIII.

MIOCENE CAMELIDÆ

Nomenclature

Cope 1880-3	Revised 1915
Protolabis transmontanus	Miolabis transmontanus
Protolabis heterodontus	Protolabis heterodontus

- FIGS. 1, 2. *Miolabis transmontanus* (Cope, 1879). Skull, lateral and palatal views, two-thirds natural size. Type specimen, Amer. Mus. No. 8196, Cope Coll., from Mascall formation of Cottonwood Creek, John Day Valley, Oregon.
- FIGS. 3, 4. *Protolabis heterodontus* (Cope, 1874). Upper and lower jaws, side view, and palatal view of upper jaw, two-thirds natural size. Type specimen, Amer. Mus. No. 8296, Cope Coll., from Pawnee Creek beds, near Pawnee Buttes, Weld Co., Colorado.



1-2 PROTALABIS

PLATE CLIV.

SKULL AND JAWS OF MIOCENE CAMELS

Nomenclature

Cope 1880-3

Revised 1915

Procamelus angustidens Cope 1872 = *Protolabis angustidens* Cope

"*Procamelus angustidens*" Cope 1881 = *Procamelus inaequidens* sp. nov.

FIG. 1. *Procamelus inaequidens* sp. nov. Side view of skull and jaws, No. 8446, type, from Upper Miocene, Republican R. beds, Driftwood Creek, Hitchcock Co., Nebraska. This skull was referred by Cope to *P. angustidens*, but differs from topotypes of that species in the absence of the upper incisors and other characters of less moment.

FIGS. 2, 3. Inferior and superior views of same skull.

FIG. 4. *Protolabis angustidens* Cope, 1872. Lower jaws, type specimen, superior view. From Middle Miocene (Pawnee Creek beds) near Pawnee Buttes, Colorado. Cope Coll., Am. Mus. No. 8294.

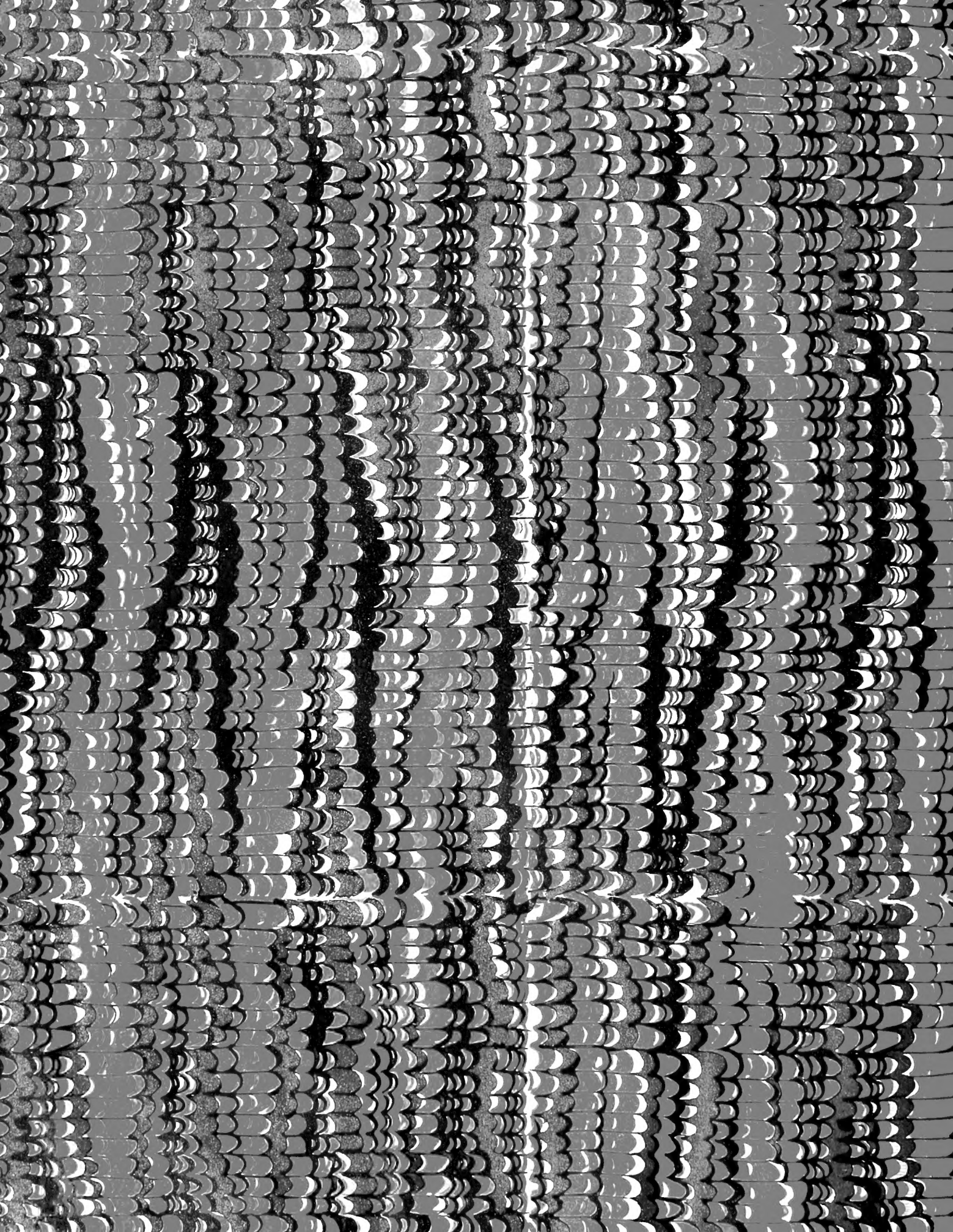


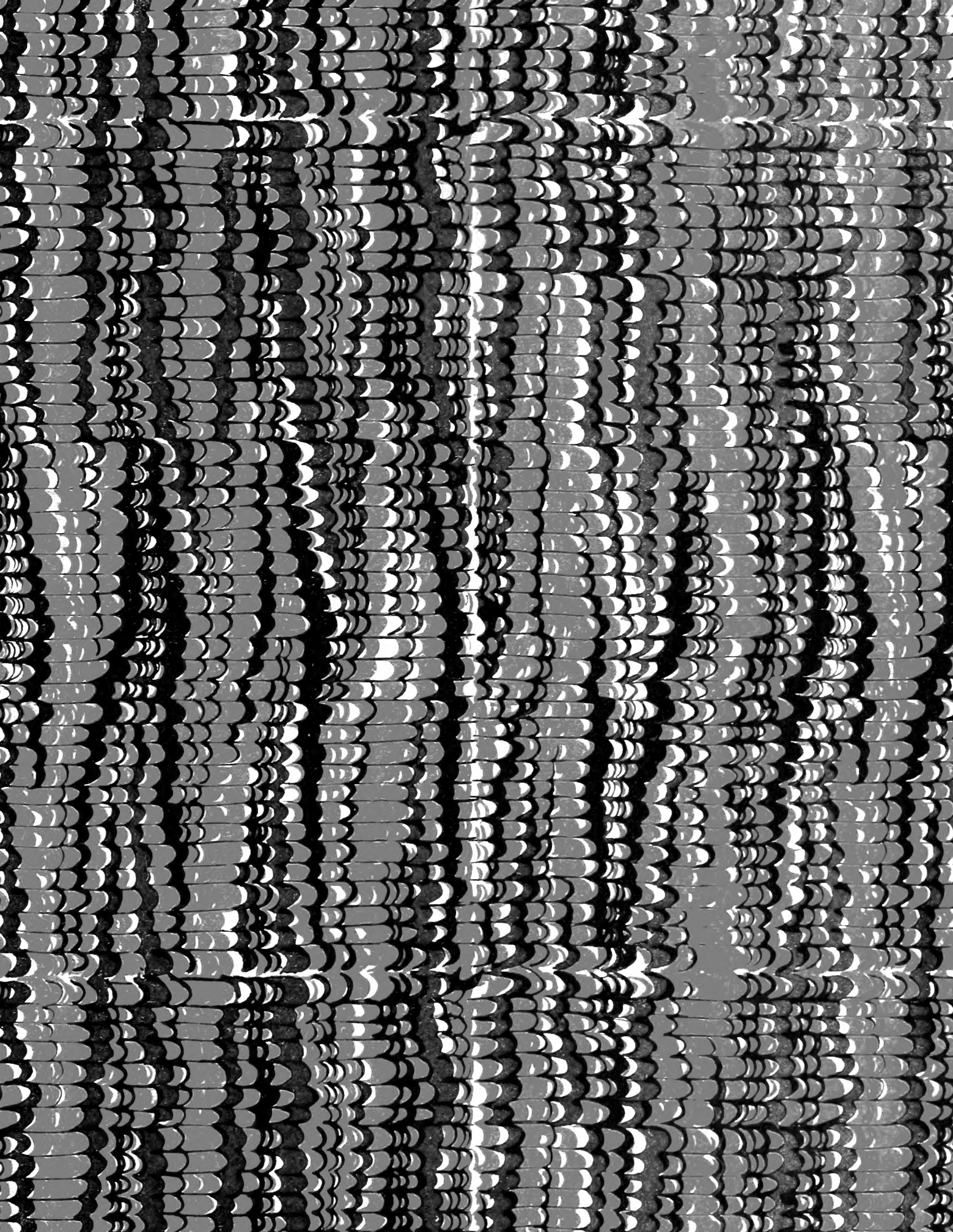
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